United States Department of Agriculture

Soil Conservation Service

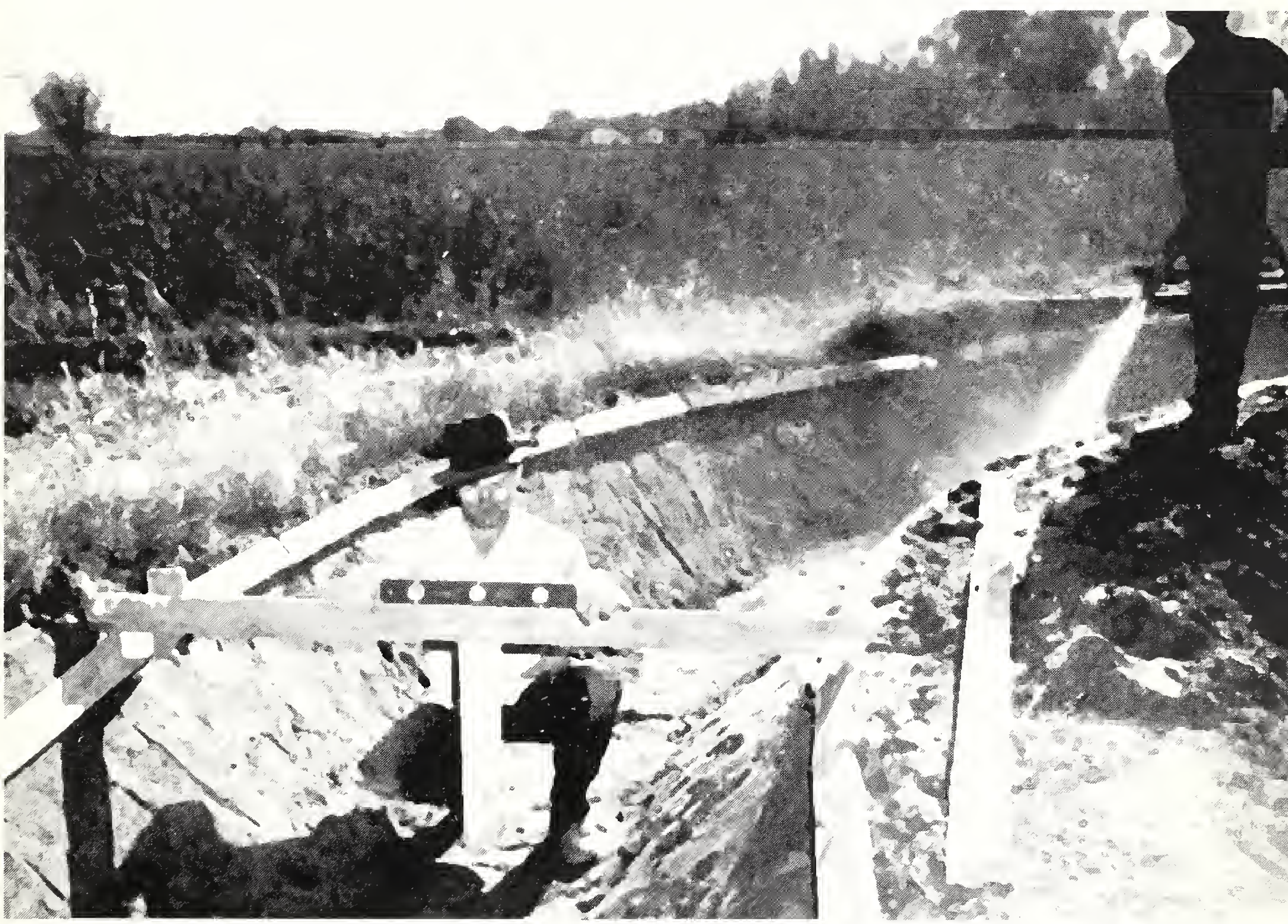
Engineering in the Soil Conservation Service

John T. Phelan and Donald L. Basinger

Engineering Division

Economics and Social Sciences Division, NHQ

Historical Notes Number 2



Cover: Spraying a mixture of cement, sand, and water on a prepared ditch bank with a Jetcrete hose and nozzle. Texas photograph number Tex-46608. Soil Conservation Service.

July 1993

Table of Contents

Preface

The object of this paper is to document some of the developments that have brought the engineering profession in the Soil Conservation Service (SCS) to its present high level of competence and production.

There have been thousands of engineers, geologists, architects, technicians and others who, though unheralded, have contributed to the engineering proficiency of the Service.

This account is far from complete and many who deserve special recognition have been missed. We apologize for any errors. However, the authors hope that this will provide some help to others who someday will prepare a more comprehensive record.

Our thanks are due to Douglas Helms, SCS Historian, and to the retired and active members of the SCS family who have contributed memories, searched their files for old records, and generously contributed to the endeavor.

INTRODUCTION

The Soil Conservation Service (SCS), now as in the past, relies upon interdisciplinary cooperation among many professionals to accomplish its mission. Rather than being dominated by one discipline as was the case in other government agencies of the time, Hugh Hammond Bennett, creator of the agency, believed that the several disciplines needed to work together for the common goal of soil and water conservation. This emphasis upon a multi-disciplinary work force has proven to be the strength of SCS.

The authors of this study each served as director of the Engineering Division: John T. Phelan, 1971-1974 and Donald L. Basinger, 1984-1989. Their historical perspective on the development and contributions of engineering to the conservation effort is valuable to current employees in SCS. The Service thanks them for volunteering their time, effort, and experience in writing this volume. SCS also thanks J.D. Ross and Steve Phillips of the Economics and Social Sciences Division for their assistance in preparing this volume.

Gerald D. Seinwill, P.E.
Director of Engineering
Soil Conservation Service

Douglas Helms
National Historian
Soil Conservation Service

ENGINEERING IN THE U.S. SOIL CONSERVATION SERVICE

*John T. Phelan and Donald L. Basinger**

TECHNICAL HERITAGE

Engineers in the Soil Conservation Service (SCS) have a rich and significant legacy. Though the agency and its predecessor, the Soil Erosion Service (SES), only date back to 1933, much valuable research, field trials, evaluations and studies had been conducted earlier. Many of these investigations were made by personnel in the Department of Agriculture, but other Federal departments, bureaus, State agencies, universities and private individuals and organizations also made important contributions. The work of these early scientists and engineers provided a solid foundation for conduct of an operations program when national concern with the soil erosion problem demanded action.

Observations and reports on the problem of erosion had been noted for centuries. In the United States, several perceptive observers in the eighteenth century wrote of the soil losses. But with new lands available to be broken in the west, farmers were not especially concerned. In fact some farmers spoke of having "worn out" one farm before they settled westward.

It should be noted that the Bureau of Public Roads and the Weather Bureau were initially agencies in the Department of Agriculture (USDA). While within the USDA, these organizations did important early work in the fields of hydrology, water supply, irrigation and drainage. The Bureau of Chemistry and Soils and the Bureau of Agricultural Engineering, some of whose functions are now with the SCS, also conducted programs and studies that still guide engineering design.

As early as 1862 the USDA demonstrated interest in landscape architecture. William Saunders was employed as a botanist and superintendent of propagating gardens and during his 38 years of distinguished service, he was responsible for such important works as the layout of Gettysburg Cemetery and contributed to the landscaping of the Capitol grounds and the streets and parks of Washington, DC. His photo is on the frontispiece of the 1900 Yearbook of Agriculture.

Probably the earliest responsibilities of federal engineers in the field of soil and water lay in their involvement with irrigation. Early Department work included "Irrigation Investigations" undertaken in 1898 and drainage studies instituted in 1902.[1] The settlement of the western states in the nineteenth century often dictated the development of irrigation projects, the construction of canals and laterals, the preparation of field surfaces, and an improvement in cultural and water application methods.

* Former Directors, Engineering Division, USDA Soil Conservation Service.

Many projects were constructed by private companies and groups. Construction of water supply and delivery systems by the Bureau of Reclamation, U.S. Department of the Interior (USDI) was authorized in 1902.

Since irrigation water is necessarily applied somewhat in excess of the amount that is used by the crop, waterlogging or ponding may occur when soil and slope conditions do not permit the excess water to escape. Irrigation intensified these problems on the new lands and drainage grew in importance. Similarly in humid areas, inadequate drainage was causing crop damage. Some limited technical guidance and assistance with their irrigation and drainage problems were available to farmers through state colleges and the Extension Service. The development of technical skills in the fields of water supply, water conveyance, application and disposal had been in process for centuries and refinements and adaptations provided the base for the programs of erosion control and flood control that came later.

Responsibility for "Irrigation Investigations" was at first assigned to the Office of Experiment Stations, USDA, later to the Office of Public Roads and after several more organizational adjustments to the Division of Irrigation, Bureau of Agricultural Engineering in 1931.[2]

That the Secretary of Agriculture recognized the need for water supply investigations was apparent in his report to the President in 1909:

> *The study of snowfall conditions in the mountainous regions has been furthered by the establishment of a large number of observing stations in the more inaccessible sections of the country. The Weather Bureau has cooperated in this work with other Government bureaus engaged in irrigation and drainage projects. As the plans progress it is expected to complete a set of observations that will greatly increase the knowledge of the annual snowfall in those remote districts from which the western streams receive their water supply.*

In 1903, the Secretary recognized the greater breadth of the engineering function when in his annual report he recommended:

> *In order that the work of this Department in the lines of agricultural engineering other than irrigation may be more definitely recognized and organized on a more permanent and satisfactory basis, I recommend that Congress change the wording of the appropriation act so as to make the general title of this division of our work "Irrigation and Agricultural Engineering."*

An early mention of "soil washing" was included in the Secretary's report in 1903.[3] In 1907 Secretary Wilson wrote:

> *...it is a national duty to see that the soil is conserved and the farm improved for the immediate benefit of the farmer and the ultimate welfare of the country.*

Even before 1928 when the paper of Hugh H. Bennett, then in the Bureau of Chemistry and Soils and W. R. Chapline of the Forest Service[4] drew national attention to the soil erosion problem, engineering studies were being conducted through the Office of Experiment Stations. Erosion control efforts, especially in the South, had long been significant and in 1934, Secretary Henry A. Wallace wrote:

> *Some 15,000,000 acres of farm lands in the United States have been terraced during the past 15 years, largely in accordance with methods developed by Department engineers.*

Beginning in 1929, erosion control research was carried out jointly by the USDA and state experiment stations on 10 soil erosion experimental farms. USDA's responsibilities were carried out under the Bureau of Chemistry and Soils in cooperation with the Bureau of Agricultural Engineering. These and earlier studies in the fields of hydrology, hydraulics, erosion and sedimentation, agricultural equipment, and basic sciences all contributed to the store of knowledge that made it possible to rapidly initiate practical conservation programs.

The previously mentioned agencies within and outside of the USDA provided the basis for a soil and water conservation program. A listing of the titles of a few of the early papers that demonstrates the character and the breadth of the work can be found in Appendix A. As might be expected, engineering technology developed in small steps, sometimes refining ancient knowledge and practices.

THE SOIL EROSION SERVICE

Consider the problem of Chief Bennett on September 19, 1933, when he was the first and only employee of the newly established Soil Erosion Service, U.S. Department of the Interior. H. H. Bennett had been a career employee in the Bureau of Chemistry and Soils, USDA, and had long recognized that a multi-disciplinary approach to the erosion problems was essential. Though the new agency was in Interior, staff had to be recruited with skills in soils, agronomy, biology, forestry and engineering. An action program had to be devised, and personnel, including engineers, hired. A few experienced people were scattered in federal and state agencies and a fair nucleus was present on the experiment farms set up earlier under the USDA.

The original staff "included experts in technical fields drawn largely from the Department of Agriculture and land grant colleges."[1] Others had to be recruited and trained. Because of the severe depression in 1933, many technically trained individuals were available though they had little experience in erosion control work.

The responsibilities of the engineers were described:

> The engineers duties are to design and construct all erosion control structures including terraces, terrace outlet channels and terrace outlet protective structures; gully control structures including dams, baffles, head protectors, bank sloping and bank protection; contour furrowing in pastures; and the installation of measuring and sampling devices accurately to measure the soil and water loss from controlled experimental plots.[6]

Field work expanded almost immediately and by the end of November the Civil Works Administration (CWA) had provided emergency labor to the Service. Seven of the regularly established projects were assigned 1,835 men to assist with the work. An additional force of 1,036 was assigned to the Gila River Watershed in Arizona. The CWA program however was short lived and only continued until the middle of February.

The policy under which the work was done was reported:

> ...the Government provides the cooperator with the necessary seed, but the cooperator undertakes to plant the seed and protect the area in vegetation from overgrazing and fire. In other instances, it is necessary to treat large gullies with control structures or to build terraces. In these instances the farmer usually agrees to furnish the necessary horses and to move the earth needed to build the gully control structure, and also to complete the terraces by filling in the low places which may be left by terracing machinery. The Government, on the other hand, agrees to furnish the labor to build the gully structures and to supply equipment and part of the labor necessary to construct the terraces.
>
> Thus, the entire project is carried out on a cooperative basis. It is estimated that, on the average, the owners or operators contribute approximately 40% of the cost of the operation and the Soil Erosion Service or the ECW camps, operating under its direction, contribute the remaining 60% of the cost.[6]

Only 9 months later, on June 30, 1934, there were 2,200 persons employed in the Soil Erosion Service.[5] In the year and one half while under the SES, 37 demonstration projects involving private lands, three land-rehabilitation projects on Federal land, and about 50 Civilian Conservation Corps (CCC) camps were established for erosion control and

staffed with the necessary engineering and other technical personnel. Since many of the field engineers had little or no experience in designing and applying conservation practices, they had to rely on instructions in scattered publications and advice from the few experienced personnel. It is a credit to the organizational skills of the leadership and the competence and adaptability of the new personnel that the work was successfully carried forward.

While under the Department of the Interior, principal staff of the Soil Erosion Service was:

Director .... H. H. Bennett
Vice Director .... Walter C. Lowdermilk
Chief of Operations .... Wm. Stephenson
Tech.Secretary .... Robert A. Winston
Chief Agronomist .... Lyman Carrier
Ch.Agr.Engineer .... James G. Lindley
Spec.in Erosion .... Glenn L. Fuller
Ch.Forester .... E. V. Jotter
Ch.Fiscal Officer .... Henry R. St. Cyr
Special Asst. .... Charles W. Collier*

During this same period the leadership in the USDA Bureau of Agricultural Engineering was:

Chief .... S. H. McCrory
Engineering Assistant to the Chief
.... George R. Boyd
Division Chiefs - Irrigation
.... W. W. McLaughlin
Drainage and Soil Erosion Control
.... Lewis A. Jones
Mechanical Equipment.... R. B. Gray
Structures .... Wallace Ashby
Plans and Services .... M. C. Bitts

Many of the individuals then in the Bureau of Agricultural Engineering were later prominent in the organization and work of the SCS.

The Department of Agriculture was not happy with what appeared to be an attempt to build up a duplicating organization within the Department of the Interior and Interior had some doubts as to the propriety and legality of furnishing direct government assistance to private landowners. A committee appointed by the Secretary Ickes of Interior studied the organization and their recommendations resulted in the transfer of erosion control research and operation on private lands to the USDA.[1]

---

* In a report prepared for the National Endowment for the Arts, April 1989, by Sally Schauman, mention is made that landscape architects were on the staff when the agency was formed in the 1930's. It is presumed but not verified that this referred to Charles W. Collier, B. Arch.

ESTABLISHMENT OF THE SOIL CONSERVATION SERVICE

On March 25, 1935, all funds, personnel and property of the Soil Erosion Service were transferred to the U.S. Department of Agriculture. Under the new organization, the Soil Erosion Service became responsible for the soil erosion investigations and regional experiment station functions which previously had been conducted jointly by the USDA's Bureau of Chemistry and Soils and the Bureau of Agricultural Engineering.[5] This brought a number of experienced engineers into close association with the operations staff and greatly strengthened the program. By the end of 1935 fiscal year, the total number of SCS employees totaled 6,622--95 percent of whom were in the field.

A few days later, on April 27, 1935, the Soil Conservation Service was established under the Secretary of Agriculture and was directed to include the activities formerly conducted by the Soil Erosion Service. The new agency moved from Interior offices and was first headquartered in the Standard Oil Building at 2nd Street and Constitution Avenue, NW. About 1938, the executive offices were moved to the South Building of the Department of Agriculture, but some of the personnel continued to be located at the Standard Oil Building until about 1942.

At the time of the transfer from Interior to Agriculture, there were 39 active erosion control projects with 51 Emergency Conservation Work (ECW) camps. Technical guidance for the ECW camps was provided by the personnel attached to the demonstration projects. Engineering staffing on the demonstration projects varied according to the need. Because of the labor and some materials provided through the projects and camps, the conservation work was applied at a reduced cost to the cooperating farmers. The installation of mechanical practices, i.e., terraces, waterways, gully control structures, farm ponds, etc., comprised a large part of the work effort.

The principal and engineering staff of the SCS in early 1935 at the Washington Office included:[7 8]

Chief	H. H. Bennett
Assoc. Chief	Walter C. Lowdermilk
Asst. Chief	Henry D. Abbott
Tech. Asst.	Robert A. Winston
Spec. Asst.	Charles W. Collier
Spec. Asst.	Henry H. Collins, Jr.
Liaison Officer (ECW)	J. G. Lindley

In the Division of Conservation Operations, the staff included:

Chief	Courtland B. Manifold
Section of Engineering	
Acting in Charge	T. B. Chambers
Assistant	Samuel B. Andrews
Asst.Agr.Eng.	R. L. McGrath
Section of Erosion Control Practices	
Acting in Charge	Ervin J. Utz
Section of Erosion Investigations	
Chief	R. V. Allison
Section of Sedimentation Studies	
Chief	Henry M. Eakin
Section of Watershed Hydrologic Studies	
Chief	C. E. Ramser
Section of Climatic & Physiographic Studies	
Chief	C. W. Thornthwaite

Other engineering personnel on the staff of the SCS in 1935 are shown in Appendix B. Many other engineers were employed with funds from the Emergency Conservation Works and served in CCC camps and other activities under the direction of the SCS. In 1938, the following were attached to the engineering division in the Washington Office: T. B. Chambers, N. R. Beers,

H. T. Cory, C. L. Hamilton, G. E. Ryerson, A. H. Davis and W. X. Hull.

Erosion Control Practices

The control of erosion on private lands was a major assignment and the cooperation of landowners was essential. In the projects and camps, terrace construction was generally accomplished with the farmers' own or hired labor, power and equipment. At some locations, local governments allowed landowners to hire their earth moving equipment and operators. Seldom could contractors be found to perform work. The SCS provided the planning, layout and inspection of construction and, as an incentive, took the responsibility to provide the terrace outlets. With labor provided by the ECW camps, and materials by the SCS, both vegetated and mechanical outlets were constructed.

For the construction of farm ponds and erosion control dams, the government provided the design, layout, and inspection. Through the ECW camps they also provided the needed labor and "fresnos" or slips to move the earth. Farm tractors or horses were customarily provided by the farmer and since the farm animals were fondly regarded by their owner, it was important that the enrollee teamsters be carefully chosen and trained. When structural elements such as trickle tubes or mechanical spillways were required, the farmer provided most of the materials.

Gully control work was a major task in the 1930's and required much CCC and Works Progress Administration (WPA) labor.* The smaller gullies could be controlled with a series of brush dams if followed with the establishment of vegetation. With some deep head cuts it was necessary to divert the runoff, slope the banks, and establish vegetative cover. On larger drainages it was sometimes necessary to install permanent structures, such as drop inlets or flume spillways. The farmer was expected to provide most of the materials for this construction.

Posts and wire for the construction of brush dams were furnished either by the farmer or government or both. Often the CCC enrollees or WPA laborers cut the posts from existing timber stands. Brush was cut wherever it could be found--usually on riverbanks. Trees or other vegetation were planted in the silt collected above the dams to permanently hold the soil in place.

Some county governments became interested in replacing some of the bridges that were being undermined with drop inlet or grade control structures. The farmer often cooperated in a joint effort, sharing the cost of the material and earthwork. The SCS provided the plans and the CCC or WPA the labor.

When fencing was required to protect new trees or other plantings, posts could sometimes be cut from woodlots or hedgerows on the farm. In other cases the fencing materials were provided by the farmer, the government or both, and

* E. B. Stauber, a pioneer settler, told that when he first came to Thayer County, NE, no one could drive across the county without encountering a gully. In the 1930's hardly a farm did not have one or more raw gullies that interfered with cultivation. During a recent tour of the area, scarcely a gully could be found.

the labor was provided through the camps or WPA.

Of course all structural installations were supported with vegetative measures, and seed collection and tree planting were tasks that seasonally took much labor.

Research Programs

Associate Chief Lowdermilk designed much of the early research work and became chief of the research division on April 24, 1937. Soil erosion investigations previously conducted by the Bureau of Chemistry and Soils became the responsibility of the SCS. In 1939, the work of the Divisions of Irrigation and Drainage of the Bureau of Agricultural Engineering relating to investigations, experiments, and demonstrations on the construction and hydrologic phases of farm irrigation and land drainage (including snow surveying responsibilities) was transferred to the SCS.[5] In the engineering field, this transfer brought a number of eminent engineers and scientists into the organization and provided a solid technical base for the development of an operations program.

Lowdermilk was followed by Dr. Mark L. Nichols who was widely known as the originator of the Nichols terrace. In 1934 he had been honored by the American Society of Agricultural Engineers (ASAE) with the Award of the McCormick Medal and in 1946 he was elected president of that organization.

C. Warren Thornthwaite, a geographer widely known for his development of the Thornthwaite procedure for estimating the consumptive use of vegetation from climatic data, was placed in charge of Climatic and Physiographic Investigations. Henry M. Eakin, an outstanding authority on sedimentation, headed the Sedimentation and River Hydraulic Investigations. C. E. Ramser, internationally known authority on the application of the sciences of hydraulics and hydrology and later winner of the ASAE John Deere Medal in 1944, directed Watershed Hydrologic Studies. R. V. Allison, a soil scientist, was charged with Erosion Investigations, and S. B. Detwiler, an agricultural chemist, provided the direction to Hill Culture Studies.

Other prominent engineers and scientists who came to the SCS operations program from research activities or from the Bureau of Agricultural Engineering included Lewis A. Jones, Farm Drainage; W. W. McLaughlin, Farm Irrigation; Gilbert C. Dobson, Sedimentation; George W. Musgrave, Infiltration; Russell E. Uhland, Soils; Carl B. Brown, Sedimentation; James H. Stallings, Agronomy; John J. Sutton, Drainage; George D. Clyde, Irrigation; and Gerald E. Ryerson, Conservation Equipment.

While under the administration of the SCS, significant progress was made with studies to understand soil and water relationships and climatic influences on both water and wind erosion processes. Hydrologic and hydraulic studies led to improved understanding and design of structures. The collection methods and analysis of snow survey data together with the dissemination of the forecast reports on the available water supply to state authorities and farmers were greatly improved. Progress was made in the development of over-snow vehicles to facilitate the collection of snow pack data--greatly influencing the later development of the popular snow vehicles by commercial sources. Procedures for evaluating irrigation

methods and improving water conveyance and application were developed. Improved criteria for surface and subsurface drainage works were established.

Perhaps the greatest benefit from having some engineering research in the Service was the close working relationships that developed between the research and operations staffs. The field activities on the many cooperative farms provided a large and practical laboratory to supplement research studies. Field problems could be rapidly investigated and joint efforts led to timely and effective solutions.

In 1953 when all SCS research activities were transferred to the Agricultural Research Service, many of the personnel and others who had come to the Service from research agencies remained in the operations program. The snow survey program, which had been a part of irrigation research, remained with the SCS.

EMERGENCY WORK PROGRAMS

Civilian Conservation Corps

The Emergency Conservation Work Act of March 31, 1933 (ECW) was the basis for the establishment of the Civilian Conservation Corps (CCC) and the Civilian Conservation Corps Act of June 28 further clarified this authority. Congress passed the first bill a week after it had been requested by President Roosevelt and on April 5, 1933, the executive order was signed appointing a Director of Emergency Conservation Work to carry out the purposes of the Act. Six weeks later, more than 1,300 camps had been designated and were in the process of being built by the first recruits. Twenty-two camps were assigned to and commenced operations under the technical direction of the Soil Erosion Service on April 1, 1934. Shortly thereafter the SCS came into being and the number of camps assigned was raised to 204. By September 1935 there was a grand total of 2,427 CCC Camps, of which 500 were assigned to demonstrate erosion control practices to the farmers of the Nation.

Enrollees were unmarried male citizens between the ages of 17 and 23 years. Exceptions were made for a limited number of war veterans assigned to Veterans Conservation Corps camps (VCC). There were also a few camps for Indian enrollees, though in some areas, Indians were recruited along with other local personnel. Enrollment periods were for not less than 6 months and not more than 2 years.

Reserve military officers were responsible for housing, clothing, feeding, medical attention, pay and discipline of the enrollees. Usually the military camp staff consisted of a commanding officer, an assistant, a military or contract doctor, and an educational advisor. Enrollees were entitled to $30 per month, $25 of which went directly to the parents or family of the enrollees. Leaders and subleaders got a few dollars more. Camps usually had an authorized complement of 200 enrollees (not always maintained) and a considerable number were needed for camp operation and maintenance. An average of about 160 enrollees were available for conservation work and daily were turned over to the SCS for field work. The CCC camps had their technical backstopping from the staff of whichever of the 39 erosion control projects to which they were assigned. A few camps were assigned to SCS nurseries. Multidisciplinary teams including engineers, agronomists, soil scientists, foresters, and others regularly visited the camps to evaluate work and conduct training. Structural designs in use on the projects generally formed the model for similar work at the camps. A sort of job approval authority was in place and uncommon structural design was prepared by the camp engineer and submitted to the project director for approval.

The SCS technical staff at the erosion control camps often consisted of a superintendent, one or two engineers, an agronomist, and a soil scientist. Usually four foremen, one of whom usually doubled as forester or other needed specialty, supervised the work of the enrollees and were responsible for training them in construction skills. Beside the design, staking, and supervision of structural measures, other important and time consuming tasks for the engineers in the camps were farm mapping (before aerial photographs became available), assistance with farm

planning, and the field layout of strip cropping and contour lines. Except during the tree planting season, most of the manual work was structural and the major responsibility for developing work schedules fell upon the camp engineers. A number of the enrollees were trained to conduct field surveys, draft plans, etc. Some of these later were employed by the SCS to serve as subprofessionals in the soil and water conservation district programs. A few went on to college and then returned to the SCS in a professional capacity.

Trucks transported the enrollees to the field--leaving about 7:30 a.m., and the work assignment was 6 hours, 5 days a week. The military provided a noon meal, sometimes hot, at the field locations. Returning to the camp in middle or late afternoon, the enrollees were provided recreational and educational opportunities. Under the auspices of the civilian camp educational advisor, SCS technical personnel often conducted classes in the evenings on subjects requested by the enrollees.

Some camps supervised by the SCS had been given specialized assignments. In Kansas, the CCC constructed a series of lakes in state parks in cooperation with the Kansas Forestry, Fish and Game Commission. CCC crews made a large contribution in the SCS nurseries producing plant materials. The technical staffs at these locations were organized according to the work requirements.

One important product of the ECW work in the projects and camps was the opportunity to determine the amounts of labor, materials, equipment required and the cost of installing conservation measures. Detailed time and cost records were kept and reported to regional authorities who then were able to assemble data used in promoting conservation measures.

The ECW and the CCC programs were gradually phased out and eliminated early during World War II. Beginning in 1941 and continuing till 1947, Civilian Public Service Camps were established as part of a program of employing conscientious objectors. The Selective Service allotted as many as 15 of these camps to the SCS for erosion control work.

In 1941 upon the occasion of the eighth anniversary of the CCC, Chief H. H. Bennett wrote:

> *Possibly this generation will never fully appreciate what the C.C.C. is doing to build the internal strength of America. So many things of immediate magnitude are taking place every day that we are likely to overlook some of the long-time gains being made in our time. But the C.C.C. is making history, and as history is written in the future it will record that in the 1930's and 1940's the C.C.C. made an invaluable contribution to the conservation of America's most vital natural resource - its soil.*
>
> *I doubt seriously whether the importance of the C.C.C. contribution to soil conservation in the United States can be over evaluated.*

Works Progress Administration Participation

At some SCS activities, the WPA provided labor for work on government lands and projects. The WPA was a work relief program that provided emergency employment for local citizens. A local representative of the WPA managed the operation in accordance with an approved plan. The SCS planned and supervised the installation of the conservation measures. In 1936 the peak of WPA relief employment was reached when 23,709 workers were on the payroll

for SCS work. It was phased out early during World War II.

In some areas, the great need to provide work relief led some local organizations to sponsor WPA programs of a quasi-conservation nature. Often these involved the construction of dams, generally small farm ponds, but sometimes of a size or hazard that would classify them as important structures. Local surveyors and engineers were hired to provide the plans and supervise construction and the pressure to provide work sometimes led them to approve questionable projects. Generally the WPA work was good but in some instances could be considered substandard and some confusion with respect to the quality of "government" work resulted. At some locations, this led to a competitive attitude between the WPA and SCS that lasted for a couple of years.

Related Conservation Programs

A companion agency authorized in 1933 was the Agricultural Adjustment Administration (AAA), a program to reduce acreage in return for government payments. With the assistance of county extension staffs, local associations of producers were organized to administer the program. This program was invalidated by the Supreme Court in 1936. Less than two months later, the Soil Conservation and Domestic Allotment Act of 1936 was passed to:

> *...promote the conservation and profitable use of agricultural land resources by temporary Federal aid to farmers and by providing for a permanent policy of Federal aid to States for such purposes.*

Several new conservation programs including the Agricultural Conservation Program (ACP) ultimately were established under this authority. The ACP permitted payment to farmers for the establishment of conservation practices.

NEW AUTHORITIES

In the 1930's, a number of new programs were authorized which expanded the responsibilities of the SCS and allowed the Service to include flood control, irrigation and drainage works in operation programs and truly fully embrace the soil and water conservation functions.

Flood Control and Watershed Protection

The Flood Control Act of 1936 for the first time recognized the importance of providing watershed protection and flood prevention as complements to the downstream flood control program of the Corps of Engineers. Prior to 1937, SCS was not authorized to provide technical or other assistance for water conservation measures.

The Acts of 1937, 1938, 1939 and 1940 authorized the USDA to work on the uplands of the same streams that Congress had authorized for work by the Corps. In August 1937 the first allotment of flood-control funds was approved for SCS--transferred to the USDA from the War Department. In November 1938, SCS was given the responsibility for flood control operations on lands which were predominately agricultural. Preliminary examinations followed by detailed surveys resulted in the authorization for operations on eleven watersheds by the 1944 Flood Control Act.

In 1953 the Secretary of Agriculture assigned the responsibility for administration of all of USDA's flood control and river basin activities to SCS. A "Pilot Watersheds Program" followed, and by the end of 1953, 62 pilot projects were selected to demonstrate the practicability of complete watershed protection to reduce flood and sediment damage, associated problems, etc., and to evaluate hydrologic effects and economic benefits.

Finally on August 4, 1954, the Watershed Protection and Flood Prevention Act (P.L. 566) was approved authorizing a nationwide program to provide technical and financial assistance to local groups for upstream watershed conservation and flood control. The size of upstream watersheds was limited to 250,000 acres. River basin investigations also were authorized. This Act repealed the authority for flood prevention measures under the Flood Control Act of 1936 except for the programs authorized on 11 major watersheds.

Watershed planning and operations programs expanded rapidly and led to the establishment of a new position, Deputy Administrator for Watersheds, with Watershed Planning, Watershed Operations, and River Basin Divisions. In addition to the large number of engineers, geologists and engineering-related professionals required to provide assistance, many engineers were assigned to administrative functions because of the quasi-technical nature of the positions. The design and construction responsibility for watershed structures remained with the Engineering Division.

As the organization pattern of the Service evolved over the years, engineers continued to play an important part in administrative as well as technical positions.

Of the 1,494 projects approved for operation under P.L. 566, 712 are now completed. The works installed include over 6,000 dams and over 10,000 miles of improved channels. The Federal input

into this program exceeded 3 billion dollars and an additional 2 billion was provided by local governments, agencies and organizations.

Water Facilities Program

The Water Facilities Act of August 28, 1937, authorized the Secretary of Agriculture to plan and construct agricultural water storage and utilization projects in the arid and semiarid areas of the United States. In 1938, the Secretary assigned the responsibility for the Water Facilities Act of 1937 to the SCS. This included the "construction and installation of water facilities, development of conservation management plans for farms and ranches where the work was carried on, and the rendering of technical advice on water-facilities matters."[1] In the Water Facilities Program, the USDA's Bureau of Agricultural Economics had the responsibility for advising on the selection of project areas and the preparation of an area plan, and USDA's Farm Security Administration was responsible for making and servicing loans for the farm or group installations, while the SCS prepared the conservation and engineering plans and supervised construction. Mostly the work consisted of the planning and development of available groundwater and surface water supplies for farm and domestic use and constructing and rehabilitating small irrigation and water-spreading projects. At some locations where contract services were not available, the Service had earth-moving and other construction equipment available to perform the work. At the local level, this program demanded especially good relations and close coordination with the Farm Security Administration since representatives of both agencies were dealing with the landowner or farmer.

In 1942 the program was transferred to the Farm Security Administration, and in 1954, the Water Facilities Act was amended extending the loan program to the whole nation. The SCS cooperates in the technical aspects of the program but does not have responsibility for operations.

Land Utilization Projects

Also in 1938, responsibility for a part of the Land Utilization Program (LU) was assigned to the SCS. Initiated in 1935, the program had successively been in the Resettlement Administration, Farm Security Administration and Bureau of Agricultural Economics.[10] In these projects large areas of submarginal private lands were purchased by the government with the intent of assisting farmers and ranchers stranded on poor land to get a new start elsewhere. Over seven million acres were placed under SCS administration. The number of farm or ranch operating units was reduced to the number that the area would support, unnecessary farm headquarters eliminated, needed conservation practices applied, vegetative cover improved, and strict grazing controls enforced.

The principal engineering operations on the LU projects were the development of new and the rehabilitation of old farm ponds, dugouts, springs and wells to provide water for the grazing animals. Some small irrigation and water spreading projects were installed to increase feed supplies. Another major task for the engineers was the location of the government property boundaries and the construction of the necessary fencing. And of course, all project personnel were charged with the prevention and suppression of prairie and timber fires.

In 1953, responsibility for the administration of LU lands was transferred to the Forest Service. Some of the original LU projects have since been incorporated as "National Grasslands."

Wheeler-Case Projects

Senator Bert Wheeler of Montana and Congressman Francis Case of South Dakota introduced an act in 1939 with the avowed intention of requiring the Departments of Interior and Agriculture to work together in the planning and development of small water projects. The act authorized the U.S. Bureau of Reclamation (USBR) to establish small water conservation and utilization projects in the Great Plains and other arid areas of the west. These projects were to be partially paid for by labor and supplies from the WPA and CCC since it was accepted that the cost of irrigation was too great to be fully repaid if undertaken under reclamation law. It was further provided that the Department of Agriculture would participate in the planning and development of the project lands.

The USDA's responsibility was initially assigned to the Farm Security Administration and about seventeen projects were initially authorized for study in the states of Idaho, Colorado, Montana, North Dakota, Nebraska, South Dakota, Texas, Utah and Wyoming.

On the larger projects, the Farm Security Administration (FSA) in cooperation with the Bureau of Reclamation evaluated the lands to be irrigated, acquired the land needed for project purposes, and was responsible for the development of theland and its resettlement. The farms were intended to be of subsistence size for a farm family. The Bureau of Reclamation was responsible for the development of the water supply, construction of the needed distribution system and major drainage works, and, upon completion of the project, transfer of the operation and maintenance of the project works to a local organization.

Some of the smaller projects were completed prior to World War II, when all work on the projects was suspended. After the war, it was decided that even though the projects underway could not be economically justified, the projects should be completed and the completely developed farms sold to veterans on favorable terms at a subsidized price that would establish an economically justified farm unit. Competition for these developed units usually required that the new settlers be selected by drawings after eligibility standards had been met.

In 1945, the duties of the Farm Security Administration in connection with these projects were transferred to SCS. Major work on about six of these projects remained to be done. Prior to the war, the needed land had been acquired and project plans developed. Immediately after the war, the FSA had reinitiated the work and the projects were in various stages of completion. The projects on which the SCS made a major impact were:

Buffalo Rapids Project I	Montana
Buffalo Rapids Project II	Montana
Buford Trenton Project	North Dakota
Mirage Flats Project	Nebraska
Angostura Project	South Dakota
Eden Valley Project	Wyoming

The engineering functions on these projects included the planning of the farm sizes and boundaries based upon the topography and classes of soil. A system of roads was an essential part of

the planning. This was a cooperative endeavor with the USBR and local authorities so that water deliveries could be efficiently made to each farm and an infrastructure provided. The necessary land leveling and construction of the on-farm irrigation and drainage facilities was performed by the SCS using either contract or force account procedures. Several of the projects were tens of thousands of acres in size.

After the land development was completed, the engineers made metes and bounds surveys of the farm boundaries and wrote legal descriptions to permit sales to the selected veterans. Work on the Wheeler Case projects was concluded in 1960.

ORIGINAL TECHNICAL ORGANIZATION THROUGH 1953

Washington Office

The organization of the Washington Office in 1939 included Chief H. H. Bennett and a number of assistant chiefs. Technical operations was under Assistant Chief Courtland B. Manifold, and the chiefs of the divisions were:[5]

Agronomy	Charles R. Enlow
Biology	Ernest G. Holt
Engineering	Thomas B. Chambers
Agr. Eng.	T. B. Chambers (Acting)
Construction Section	John S. Grant
Drainage & Irrigation Section	John G. Sutton
Equipment Section	Gerald E. Ryerson
Hydrology Section	T.B. Chambers (Acting)
Farm Planning & Mgt	N. Robert Bear
Forestry	John F. Preston
Nursery	Harry A. Gunning
Range Conservation	F.G. Renner

There was also an Assistant Chief for Research, Mark L. Nichols, and the chiefs of the divisions were:

Climatic & Physiographic	C. Warren Thornthwaite
Conservation Economics	Walter J. Roth
Cons. Experiment Stations	Alva E. Brandt
Farm Drainage	Lewis A.Jones
Farm Irrigation	W.W. McLaughlin
Hillculture	Samuel B. Detwiler
Hydrologic	Charles E. Ramser
Hydraulic Sect.	Howard L. Cook
Sedimentation Studies	Gilbert C. Dobson
Reservoir Sedimentation	Carl B. Brown

In July 1949, an Engineering Standards Unit (ESU) was established to provide in brief and usable form information on the application of engineering principles to the problems of soil and water conservation. An Engineering Council made up of the regional engineers and the chief of the Engineering Division in Washington provided general guidance to the Unit staff. First located at Lincoln, NE, the Unit staff headed by Melvin M. Culp developed standard procedures, designs, and technical materials for the use of SCS engineering personnel. The Unit was staffed with design engineers, hydraulic engineers and geologists. The first National Engineering Handbooks were prepared by this Unit.

On January 11, 1952, when a Design and Construction Division was established in the Washington Office, the ESU was redesignated as the Design Section (DS) and the personnel from the ESU were moved to Beltsville, MD.

Regional Offices

Starting in 1935 the SCS had adopted a regional type organization and by the end of fiscal 1936, the SCS had 11 regional offices, 147 demonstration projects, 48 nurseries, 23 Experiment Stations, and 454 ECW camps. ECW and SCS full-time employees totaled 10,394. As time went on, the numbers and boundaries of the regions were adjusted to better reflect work loads and maintain operation efficiency. In 1940, regional headquarters were at Upper Darby, PA (1); Spartanburg, SC (2); Dayton, OH (3); Fort Worth, TX (4); Milwaukee, WI (5); Amarillo, TX (6); Lincoln, NE (7); Albuquerque, NM (8); Spokane, WA (9); and Berkeley, CA (10).

A regional office was under the direction of a regional conservator who was responsible for administration and program operations in the region. He had a number of assistants, one of whom was the chief of Operations, who was responsible for the technical divisions. The chief of the Engineering Division typically was assisted by a couple of specialists, often a design engineer, an irrigation and drainage engineer or agricultural engineer or other specialist according to the need.

The original Regional Engineers in 1936 were:

Region 1, Williamsport, PA............C.A. Frye
Region 2, Spartanburg, SC..............John T. McAlister*
Region 3, Dayton, OH.....................Earl C. Johnson*
Region 4, Fort Worth,TX................Howard O. Matson
Region 5, Milwaukee, WI................R.W. Oberlin
Region 6, Amarillo, TX...................Edwin C. Kinnear*
Region 7, Salina, KS.........................John S. Glass
Region 8, Albuquerque, NM ..........F.D. Matthews
Region 9, Rapid City, SD ....Lionel C. Tschudy
Region 10, Berkeley, CA.................John G. Bamesburger
Region 11, Spokane, WA ....Clarence C. Johnson*

After several reorganizations, the Regional Engineers in 1953 were:

Region 1, Upper Darby, PA ....Walter S. Atkinson
Region 2, Spartanburg, SC..............Arvy Carnes
Region 3, Milwaukee, WI................Edwin Freyburger
Region 4, Fort Worth, TX...............James J. Coyle
Region 5, Lincoln, NE.....................C.J. Francis
Region 6, Albuquerque, NM ....John G. Bamesburger
Region 7, Portland, OR...................Francis K. Muceus

The Chiefs of the Water Conservation Divisions were:

Region 1, Upper Darby, PA ....John H. Wetzel
Region 2, Spartanburg, SC..............Harry G. Edwards
Region 3, Milwaukee, WI................John S. Glass
Region 4, Fort Worth, TX...............Howard O. Matson
Region 5, Lincoln, NE.....................Kirk M. Sandals
Region 6, Albuquerque, NM ....Harold B. Elmendorf
Region 7, Portland, OR...................Frederick A. Mark

Each region was divided into zones. Zones were established without considerations of state boundaries and represented areas of roughly similar farm conditions. Zone teams consisting of an engineer and vegetative specialist routinely visited the soil conservation districts and other field activities to provide training to the field technicians and program evaluation. "Zoners" reported back to the state conservationist and the regional chief of Operations with their recommendations for program improvements. In their visits, they represented all the technical divisions and they brought reports of successful techniques or deficiencies to the attention of the division directors.

State, District, and Work Unit Offices

Each state has a state coordinator who maintains relations with state agencies and a state conservationist who provides administrative and logistic support to the field offices. Within each state were a number of districts, each with a district conservationist who supervised the work unit offices and other SCS activities.

The rapid growth of the numbers of soil conservation districts immediately after World War II greatly expanded the influence of the SCS. The names of the district offices and work units were changed to area offices and districts respectively.

* These individuals were Chief Agricultural Engineers but their assignment as Regional Engineers has not been positively determined.

TECHNICAL ORGANIZATION DEVELOPMENT

From the inception of the Service, controversy existed as to the role of the Federal government in soil conservation. The Federal and state extension services had been the principal contact between the government and the farmers. When Secretary Henry Wallace, in 1936, decided to implement his authority through units of government organized under state law, the colleges and Extension Service felt that their authorities were undermined. As the soil conservation districts came into being, the technical assistance provided by the SCS expanded with little input from the state agricultural authorities. In particular the zone teams, because of their multistate authorities, were not popular with the state agricultural colleges and extension personnel. Pressures were brought to effect a change.

On Monday morning, November 2, 1953, the regional offices were abolished and a system of state offices established. The regional office personnel were temporarily transferred to the staff of the Administrator while the establishment of a new personnel organization took place.

At the same time soil conservation research was transferred to the Agricultural Research Service (ARS) and at his own request, Robert M. Salter, Chief of SCS, was transferred as Chief, ARS. Donald A. Williams, an SCS engineer who had temporarily been assigned as chief of the Agricultural Conservation Program, was appointed to succeed Dr. Salter.

Special note should be made of the problems facing Administrator Williams as he took this assignment. Morale at the Washington, regional and state levels plunged, especially among the technical staff who anticipated undesired transfers, assignments or separation. It was necessary to quickly devise an organizational pattern that would satisfy SCS's critics and yet would permit the effective operational program to proceed. The Administrator and his top assistants immediately traveled to each regional headquarters, met with the regional staffs, quickly selected the leadership for the individual states and developed the pattern that continues with only slight adjustment to the present.

Washington Headquarters

Gladwin E. Young was designated Deputy Administrator; J. C. Dykes, Assistant Administrator for Field Services; C. E. Kellogg, Assistant Administrator for Soil Survey; and W. R. Van Dersal, Assistant Administrator for Management.[12] The Administrator also had field representatives, each responsible for liaison with state and E&WP unit and field specialists in an assigned group of states.

The principal staff under the Assistant Administrator for Field Services were:

Planning Division	Carl B. Brown
Farm & Ranch Plan'g Branch	Alfred M. Hedge
Cons. Needs & Records Branch	Ethan A. Nortan
Watershed Planning Branch	John H. Wetzel
Engineering Division	Karl O. Kohler
Hydrology Specialist	Harold O. Ogrosky
Sedimentation Specialist	Louis C. Gottschalk
Infiltration Specialist	George W. Musgrave
Ag. Engineering Specialist	James J. Coyle
Irrigation Eng. Specialist	Tyler H. Quackenbush
Drainage Eng. Specialist	John G. Sutton
Cons. Equipment Specialist	Gerald E. Ryerson
Design & Construction Branch	Chester J. Francis
Plant Technology Division	Edward H. Graham
Agronomist Specialist	Grover F. Brown
Range Conservation Specialist	Fredric G. Renner
Forester Specialist	Courtland B. Manifold
Biologist Specialist	Lawrence V. Compton
Plant Materials Specialist (Vacant)	

National Specialized Engineering Units

About the same time but not necessarily related to the abolishment of the regional offices, a National Soil Mechanics Laboratory (SML) was established at Lincoln, NE, to provide technical guidance and design assistance. This laboratory was an outgrowth of the soil irrigation and drainage work pioneered in the Albuquerque, NM, Fort Worth,TX, and Spartanburg, NC, regional offices. The SML was under the direction of the Director, Engineering Division.

In cooperation with the engineering geologists, the Soils Mechanics Laboratory continued to provide national leadership in the investigation of foundation conditions, in the classification, testing and design of soil materials. The SML provided advanced testing capability of soil materials beyond the facilities available in the states and the Engineering and Watershed Planning Units. About 1973, the SML was attached to the Regional Technical Service Center for administrative purposes.

The existing Design Section (DS) continued in operation and was located at Beltsville, MD. In 1963 they were moved to Hyattsville, MD and in 1964 were renamed the Design Unit (DU). A new unit, the Central Technical Unit (CTU), was established on June 8, 1954, and was located alongside the Design Section with the mission of extending, developing, testing, and evaluating applied techniques in the field of hydrology, and sedimentation.

Their charge was to develop and recommend new methods and procedures to be used in carrying out the hydrologic and sedimentation work of the Service. The CTU became responsible for some of the functions previously carried out by the Design Section.

The CTU and DS were located together at Beltsville, MD. Both were regarded as field units. The CTU was under the direction of the Chief, Hydrology Branch, Engineering Division, while the Design Section remained with the Design and Construction Branch. In 1963 both were moved to Hyattsville, MD and in 1967 relocated to Lanham, MD.

In 1979, a National Engineering Staff was established to include the Design Unit, the Central Technical Unit and others. Their duties were expanded to accommodate all the technical needs of the Engineering Division as determined by the director and his national staff. The CTU was renamed the Hydraulic Unit.

In 1982 the Units became a part of the Engineering Division though still located at Lanham, MD. Their function continued to grow with the added responsibilities of the Service and especially with the advent of computers and computer-aided engineering. Under the direction of an assistant director, Engineering Division, they now support all SCS programs for the conservation and protection of soil and water resources and the protection and enhancement of the environment. They provide assistance to the leaders in the national engineering and geologic disciplines, the National Technical Centers and the states in developing technology which includes the development and maintenance of engineering computer software models, data bases, engineering standard procedures and technical materials. In 1983 they moved to the Cotton Annex,

USDA, Washington, DC, and are now known as the National Engineering Technology Development and Maintenance Staff under an Assistant Director, Engineering Division.

Engineering and Watershed Planning Units

Following the abolishment of the regional offices, a new office, an Engineering and Watershed Planning Unit (E&WP Unit), was devised and located at the previous regional locations. The staff at the E&WP Units received their technical guidance from their counterpart in the Washington Office and the head of the E&WP Unit was administratively and technically responsible to the Director of the Engineering Division.

The original Heads of the E&WP Units were:

Upper Darby, PA ..... Fred Larson
Spartanburg, SC .... Thomas B. Chambers
Milwaukee, WI .... C.E. Ghormley
Lincoln, NE .... Dwight S. McVicker
Fort Worth, TX .... Howard Matson
Portland, OR .... Ellis Hatt
Albuquerque, NM .... J.G. Bamesberger

The staff attached to each E&WP Unit varied according to work load and initially represented the following disciplines: watershed planning, hydrology, geology (watersheds), geology (sedimentation), agricultural economics, design, construction, irrigation, drainage, and erosion control. In addition there were aides, draftsmen, stenographers, and clerks to support the technical staff. A few E&WP Units had one or more additional specialists to handle problems important to their work area. As an example, the Albuquerque E&WP Unit had a soil materials engineer and laboratory and the Portland E&WP Unit had a soil mechanics laboratory.

As time passed, the number of the E&WP Units was reduced to six, then to four; the states served were adjusted; and additional disciplines were added to satisfy the ever changing work load.

Related Technical Support Units

Cartographic Units were usually located in the same cities as the E&WP Units to provide drafting and duplication services for all SCS offices in the states for which they were responsible. For the most part these units employed professional engineers and aides but were under the supervision of the Assistant Administrator for Soil Survey. As other reorganizations occurred, these facilities were consolidated and relocated.

Soil, plant, and biological specialists provided technical assistance to the state and field units. They were based at scattered locations and were not necessarily assigned to the same areas as the E&WP Units. Until the establishment of the Regional Technical Service Centers, these specialists reported directly to their counterpart in the Washington office.

Technical Centers

In 1965 Regional Technical Service Centers (TSC) were established to coordinate the technical expertise in assisting the states and to keep the technical specialists advised of program developments, policy changes, new procedures, and problems facing the service. Four TSC's were established and located at Upper Darby, PA (Northeast); Fort Worth, TX (South); Lincoln, NE (Midwest); and Portland, OR (West). The TSC staff was under the direction of a field representative who reported to the Administrator. Field representatives were staff officers who maintained

a close working relationship with the states and the Washington office. Technical personnel at the centers continued to be members of the staff of the division from which they received guidance. Accordingly the E&WP Units at the Regional Technical Centers continued to look to the Engineering and Watershed divisions in Washington, DC for technical direction and support.

Initially the E&WP Units retained the same disciplines within the Technical Service Center. Over the years these units became large because of the disciplines needed to assist states in project planning, operations and maintenance. In 1977 a reorganization abolished the E&WP Units and placed all the technical disciplines on other staffs, and the Technical Service Centers were renamed National Technical Centers (NTC). Each technical discipline continued to provide the same technical help to the states, but through staffs that were more interdisciplinary in nature.

In 1989, a National Water Quality Technology Development Staff was organized and located at Fort Worth, TX with a coordinator at each of the four National Technical Service Centers. The staff includes engineers, geologists, soil scientists and other specialists to meet thechallenge of improving water quality. This staff was located at the South National Technical Center and instructed to devote full time to development of needed technical materials and not to be involved in assisting states in routine technical assistance.

State Offices

Within a couple of weeks after the abolishment of the regional offices, selections of state staffs were essentially complete. State offices were enlarged, files assembled from the regional materials, and personnel transfers effected. Since it was impractical to place complete staffs for complex works in every state office, the E&WP Unit staff and specialists in the agronomic and soils disciplines were responsible for technical support. The new state conservation engineer position carried considerable responsibility and effective working relationships between the state and E&WP Unit staffs quickly developed. The original state conservation engineers and their successors are listed in Appendix C.

Field Offices

A system of work units and district offices (later renamed district offices and area offices respectively) existed under the state office. Most area offices were staffed with area engineers who provided field support to the districts. Engineering problems beyond the capability of the local staff were referred to the state conservation engineer for assistance. He/she, in turn, solicited help from engineering specialists to resolve complex problems.

ENGINEERING DELIVERY

At the inception of the Soil Erosion Service, the top engineering staff was faced with a serious problem of training the many new employees that were recruited to perform the engineering work. USDA bulletins were available, some of which had been previously authored by the top engineering staff members and other helpful information had been published by the land-grant colleges. Operational time constraints did not permit formal training and many new employees were placed in position, technically qualified but with little previous experience in the work.

Because of the nature of the multi-disciplinary work of the Soil Conservation Service, engineers made important contributions to a number of programs. The section in the Soil Survey publications on the engineering properties of soils was a collaborative effort between the soil scientists and the engineers. The conduct of the flood control and water development projects utilized many engineers in program and contract administration. Some engineers served in the Cartographic Units. Numbers of engineers moved into various nonengineering positions such as State Conservationists, Field Representatives, Administrative Officers, etc. and contributed to the overall conservation effort.

SCS has developed a unique and very successful engineering delivery system. Some have questioned the number of engineers in the organization, but in fact the number is very small when one considers the billions of dollars worth of engineering conservation practices installed on the lands of the United States. Important elements of this system include handbooks, standard plans, practice standards, an engineering job approval authority system, and the help from nonengineering and nonfederal personnel.

In 1978, an SCS policy was established requiring professional engineering registration for the Director of Engineering, the heads of engineering staffs at the four National Technical Centers and all state conservation engineers. This policy was established with the full knowledge that federal employees are exempt from state registration laws. The purpose was to assure a high level of engineering professionalism for the three levels of engineering approval authority and to promote high respect for SCS leadership by various professional engineering societies and peers. A high percentage of engineers in the Soil Conservation Service are now licensed or registered professional engineers.

Engineering Handbooks

The first "handbook" that came to the attention of the author (1935) was a mimeographed publication put together by C. E. Ramser which summarized the most important procedures for the guidance of new and junior engineers. The method of estimating peak flood flow using the rational formula, Q = CIA; gully control with diversions and brush dams; criteria for the grades, spacing and length of terraces; and simple hydraulic design of waterways were included. This was supplemented with bulletins that the individual engineer acquired from the government, university and commercial sources. Junior engineers who had their first assignment on the demonstration projects had on-job training from the senior staff. Others, especially new

engineers in the CCC camps, were thrust into the work immediately.

The development of engineering handbooks became a primary job of the regional engineering staff and in many regions these became available in the late 1930's. In September 1948 J.C. Dykes, Assistant Chief, SCS, appointed a committee to "prepare a handbook setting forth service-wide guides covering design criteria, design procedures, standard plans, standard specifications and contract procedures." On February 15, 1951, Memo 1278 was issued by the Secretary directing the development of a guide for use by technicians in carrying out the Service responsibilities in connection with permanent types of conservation work.

The first work in preparing the National Engineering Handbook (NEH) was done in the ESU and later by the DU and CTU. Great impetus to their preparation was provided when the Engineering and Watershed Planning Units were established and specialists became available to assist with the outlines established in the Engineering Division.

National handbooks must undergo rigorous and detailed technical examination to meet the requirements of the many climatic, geologic, agricultural, and cultural areas of the nation, so they take considerable time to complete. The engineering staffs at the states, regions, and Washington headquarters all participated in their development. To provide immediate, and sometimes tentative, information to the field on new techniques, materials, and procedures, a system of Engineering Technical Releases and Engineering Notes was devised with the intention that this information, if found adequate, would eventually be incorporated in the National Engineering Handbooks. Some releases have survived several decades pending handbook revision.

The first section of the NEH, "Hydraulics," was issued in 1951. Occasionally sections have been prepared and released on a chapter by chapter basis. Special note should be made of the recognition that the engineering profession has given these publications. One handbook section, "Drainage," was reprinted in its entirety in 1973 by the Water Information Center, Inc., "to make it available to all persons and organizations interested in the management of water resources for the benefit of man." Commonly, the handbooks are listed as references in textbooks and technical papers and journals published by national technical societies. In 1961 the Bureau of Reclamation published the procedure developed by SCS for estimating rainfall runoff from soil and vegetative cover data in their publication "Design of Small Dams." Consultants around the world have requested copies of the SCS handbook sections.

Many states have also prepared state engineering handbooks to cover local procedures for the selection, design, layout and inspection of the most common conservation measures applicable to the area. In these, the design elements can be more narrowly focused toward the field conditions present in the state. State handbooks also can specify recording requirements and define any more restrictive state practice standards.

The continuing development of handbooks reflects new and improved technical information useful to the field

personnel in the fulfillment of their old and new responsibilities.

Standard Plans

From the first days of the Service, many individuals began to develop standard plans for their own and associates' use. The engineers in the demonstration projects often developed standard plans to facilitate the work of the junior engineers in their project or the CCC camps that they supervised. Typical of these were plans for the construction of brush dams and small drop structures. Later, the regional engineers included some elements of standard plans in the engineering handbooks that were developed to facilitate the work in their area of responsibility. Many state conservation engineers, with the help of engineering specialists in the E&WP Units, developed manuals of standard plans to be used by field personnel for such installations as erosion control drops, irrigation structures, drainage structures, pipelines, etc.

A major advance in the development of standard plans came with the work of the ESU. Further emphasis was provided by the requirement of standards for approval of Agricultural Conservation Program (ACP) practices entitling the cooperator to Federal payments. In many technical areas, cooperation between research personnel and SCS engineers made it possible to define field problems and lead to a solution which often could be incorporated in a revised standard plan.

As time went on, improvements were made in many small steps. With the advent of electronic processing and communications, standard plans adapted to meet special conditions can now be made readily available to the field with a minimum of delay.

Engineering Practice Standards

Though standards for engineering practices had always been known through handbooks, standard plans, memos and personal communications, it became important that these be formally established when the SCS became responsible for the certification of practices installed by the farmer with financial assistance from the ACP. A National Handbook of Conservation Practices was prepared which established official names, definitions, national standards and specifications and guides to specifications for the practices commonly used in soil and water conservation programs. These standards are included in the local technical guides of each Soil and Water Conservation District and often are supplemented with more restrictive provisions as deemed necessary by local conditions.

Many of the engineering standards have been developed with the assistance of many professionals in other Federal and state agencies and research and university personnel. Often committees in professional engineering societies have participated and adopted identical standards in their literature. Standards undergo frequent review to keep them current with modern conditions and technology.

Job Approval Authorities

From the very first days of the Service, some form of authority for the approval of conservation work was present. Initially these were informal in nature and were largely defined by an engineer's supervisor. As might be expected, some restrictions quickly came into play, often because of less than fortunate experiences. When the certification of

ACP practices for Federal payments became the responsibility of field engineers, it became mandatory that a system of job approval authority based upon an individual's experience and competence be established.

Beginning in the 1950's, SCS field engineers provided direction to non-engineers to help plan, design, lay out, and check out engineering conservation practices. A formal engineering job approval authority system was developed and implemented. In 1968 the system assigned approval authority to all the field engineers and allowed about 8,000 to 9,000 nonengineer SCS employees to participate in the SCS engineering delivery system. The key has been the concept that the area engineer is responsible for, and provides guidance to, the engineering work done in the field offices within his or her area. Thus, with area engineer oversight, non-engineers such as District Conservationists, soil conservationists, and conservation technicians who have been trained, are able to plan, design, lay out and check out the more simple engineering practices.

Use of Nonfederal Personnel

The SCS has always encouraged land owners and others to participate in the layout and check of engineering practices. In the 1970's and 1980's, many conservation district technicians were hired to assist in conservation application. Because the technicians were under the technical direction of the SCS district conservationist, they were trained and given job approval authority for simple engineering practices. However, district employees are not federal employees and therefore are not exempt from state engineering registration laws. In 1985, SCS engineering policy required each state conservation engineer to review the approval authority given to the conservation district technicians. The purpose was to limit the technician's approval authority to work that does not constitute the practicing of engineering without a license.

In 1986 the Engineering Division provided direction to increase the use of conservation contractors to assist in providing engineering assistance and documentation for conservation practices. Most states have participated in this effort, and as of July 1989, it is estimated that over 400,000 hours per year for construction layout and checking are being provided by conservation contractors.

DEVELOPMENT OF ENGINEERING TECHNOLOGY

For the most part, the first engineers employed by the Service came from research and university backgrounds and the leadership was skilled in a number of professional fields of importance to the conservation program. There were no established curricula for soil conservation at that time. The junior engineers were technically trained but were thrust into new tasks with little on-job training.

In conducting the early programs, field engineers utilized elements of planning, design, hydrology, job organization, and construction techniques. They needed to acquire some familiarity with soil capabilities and recommended vegetative programs. The title "Soil Conservationist" came into use and for a period there was a movement to apply that appellation to everyone employed by the SCS. It was not long, however, before administrative purposes made it necessary to supplement the title with "(Eng)" or other parenthetical designation. Gradually more specific titles returned to use. Since every engineering specialist uses some elements of others, work loads and organizational needs often dictated that an individual, skilled in several fields, had to carry a couple of assignments. As the complexity increased, some specialties became narrower. For purposes of this discourse, an arbitrary listing of specialties is the basis for discussion.

Hydrology

Initially, the greatest technical need was an improvement in the procedures for estimating the peak flows and volumes from small watersheds. These estimates are required in preparing a sound plan forthe application of soil and water conservation measures. In the 1930's, the "Rational" formula was the state of the art for estimating peak flows from small watersheds. This formula, $Q = CIA$, expressed the flow, Q, in cubic feet per second, when the rainfall intensity, I, in inches per hour and the drainage area, A, in acres were known. A coefficient, C, corrected for the rainfall that infiltrated into the soil and its value was estimated from the slope, vegetative cover, and soil condition. The rainfall intensity was taken from weather records as the rainfall that could be expected during the time needed for flow to accumulate from all parts of the drainage area at the frequency assumed in design.

A conservative use of this formula gave values of peak flow that were satisfactory for sizing spillways on small earth dams and in the design of vegetative waterways and drop structures. However, no good procedure was available to estimate the volumes of flow that might be expected. This information was needed to effect refinements in the design of structures with large drainage areas. The expected volume of runoff was especially needed to properly size flood irrigation systems in arid climes where floodwaters were diverted to treated areas to increase production. The best information available came from gaging records on small streams when reduced to runoff volumes per square mile of drainage area.

Research in the field of hydrology had a high priority from the very first days of SCS. In 1936 C. E. Ramser was put in charge of hydrologic studies and later was in charge of the hydraulic laboratories at Spartanburg, SC, Minneapolis, MN, and Stillwater, OK, and directed the collection of hydrologic

and hydraulic data on over 60 field projects. Many researchers were primarily concerned with uncovering the fundamental principals of hydrology. SCS engineers were mostly interested in developing working tools for field use. As the research information became available, SCS engineers developed increasingly accurate and practical field procedures and promulgated their use in the field offices.

In 1954 the hydrology research program was transferred to the Agricultural Research Service (ARS), and in 1956 the SCS, in cooperation with the ARS, began the development of standardized hydrologic procedures for small, ungaged, agricultural watersheds. This led to the publishing of Section 4 of the National Engineering Handbook in 1964. Incorporated were several new and important hydrologic concepts. These concepts include (1) a system for grouping soils according to their infiltration capacity, (2) a standard system of determining the runoff potential of watersheds according to soils and land use, and (3) the use of a dimensionless unit hydrograph in estimation of peak rates of runoff. This was followed with a release for procedures to be used in urban areas for evaluating and mitigating the impact of urbanization.

SCS hydrologists have also provided leadership in the development of channel routing techniques and incorporating kinematic wave concepts for overland flow.

The SCS predictive methods have been adopted by many engineering organizations, both governmental and private. The principles have been incorporated into handbooks for several foreign countries, including India, The Gambia, and North Africa.

Snow Survey

Even before 1900, it was recognized that a measurement of the snowpack in mountainous regions would be helpful in determining the seasonal water supply that downstream irrigation farmers might expect. As early as the winter of 1908-09, the University of Nevada and the Agricultural Experiment Station developed a snow sampler and scale to determine the water equivalent of snow on the ground and began to measure pressure, temperature, humidity, wind movement, precipitation, and sunshine at the sampling sites. The data collected were correlated with the rise and fall of the water level in Lake Tahoe.

In 1917 California established its first snow survey project and in 1929 established the activity as a permanent program. Nevada established their cooperative snow survey program in 1919 and Utah followed in 1923. It is of interest that in the early 1920's, George D. Clyde of Utah Agricultural College (later SCS Director of Engineering) developed the snow sampler that subsequently was adopted throughout the West. In 1935 the Federal-State Cooperative Snow Survey was established and the USDA Bureau of Agricultural Engineering was charged with coordinating the work. W. W. McLaughlin, then Chief of the Division of Irrigation, Bureau of Agricultural Engineering (BAE), and later on SCS's national staff, is credited with the successful establishment of the cooperative survey.

By 1936, the snow survey system was extended throughout the West. Studies continued to perfect the correlation between the snowpack measurements and the runoff yield. Starting in January

1951, snow survey and water supply reports for the principal western drainage basins were issued on a monthly basis through the winter season.

The data collected by the cooperative snow survey are used by the SCS to forecast the quantities of water available for irrigation and by other agencies to forecast flood potential and to manage the water resource.

Initially, snow surveys had to rely on ski or snowshoe travel and sometimes overnight trips to reach the remote snow courses to manually collect the data. Personnel were drawn from colleges, the ranching community, state and federal agencies and from the SCS. Many SCS work unit employees played an important part in this program. Because of the hazards involved, SCS research embarked on a program to develop an over-snow vehicle, and by contracts with several western universities, several models were designed, constructed, tested and evaluated. The first machine financed by the SCS, known as the "Frandee" (after its builders, Roy France and Emmett Devine), was developed at Utah State and was the forerunner of a machine later mass-produced by Morton Thikol in Brigham City, Utah. A second snow machine development project was with Montana State, where Ashton Codd developed and built a "Sno-Bug," the predecessor of the many small machines now on the market.

Modernization of data collection techniques continued, first concentrating on communications between the snow surveys and the base stations and later on the development of remote sensors and communication relays to provide the data to the base station without travel to the snow course. SCS engineers guided the developments that led to the collection of data from remote snow courses in real time without leaving the base station.

Under the leadership of Robert Rallison, Chief, Hydrology Branch, Engineering Division, this automated system developed still further utilizing meteor burst communication. This, the largest meteor burst communication system in the world, was completed and became operational in 1980. The snow survey program was transferred to the Inventory and Monitoring Division for program direction in 1980 but the national hydraulic engineer, Engineering Division, continues to have technical responsibility for hydrologic procedures used within the program.

Hydraulics

When the Service first started, several of the SCS leadership had performed valuable work in the field of hydraulics. Fred Scobey's work on the flow of water in pipes is an example. While all SCS engineers had training in hydraulics, its application to the design of erosion control practices needed further examination.

Section 5 of the National Engineering Handbook (NEH), "Hydraulics" was first issued in the early 1950's by the Engineering Standards Unit to provide basic information on the application of engineering principles to the problems of soil and water conservation. It largely consisted of a compilation of known axioms put in a usable form for easy use. It's preparation also served to highlight the field conditions which needed additional research and study. Section 11, "Drop Spillways" and Section 14, "Chute Spillways" of the NEH followed

soon thereafter to provide the hydraulic design of these specialized structures.

A special problem existed in selecting the proper flow coefficients for use in the design of vegetated waterways. Most of the flow design criteria had been drawn from investigations on irrigation and drainage canals which were not fully applicable. William O. Ree conducted valuable research on this problem which culminated in a procedure that has been adopted worldwide.

In 1939 field engineers reported that some of the "trickle tubes" that had been installed on steep grades were flowing full contrary to the then accepted hydraulic theory. This was called to the attention of a regional engineer, who in turn referred it to research personnel at St. Anthony Falls, MN. Investigations there and at Oregon State College led to the development of a hood inlet for pipe spillways that would reliably cause full pipe flow, thereby increasing the flow capacity. Hooded inlets are now widely used--another example of an SCS solution widely applicable to other government and private use.

The hydraulic characteristics of many of the mechanical structures commonly used, drop inlets, chutes, drop structures, energy dissipators, etc., were greatly refined by the close collaboration between the SCS research and operations engineers. Research was performed in a dimensionless manner which permitted application to field installation without individual site laboratory testing. The work of Fred Blaisdell at the St. Anthony Falls Hydraulic Laboratory and William O. Ree at the Stillwater Outdoor Laboratory was especially valuable.

The SCS developed a program for the computer hydraulic proportioning of dams and reservoirs along with the linkage of several retarding measures within a drainage network. As the watershed programs grew in complexity, the use of computers provided the opportunity to evaluate the hydraulic effects of a number of planning approaches and select the optimum solution.

Engineering Geology

Earth materials are widely used in soil and water conservation measures. Probably the earliest structural use of earth by the SCS was the construction of farm ponds, terraces, and water conveyance channels. The responsibility for evaluating site conditions was initially the responsibility of the field engineer and since the works were of a minor nature, no specialized attention was necessary. However, with the advent of larger water-impounding structures, many built on yielding foundations, it became important that foundations and construction materials be thoroughly described and evaluated to provide a basis for design. Geologic investigations also became important in the planning and design of stable channels. And still later, geologists carried the major responsibility for groundwater investigations.

There was some scattered geological expertise within the SCS (mostly not in the engineering organization). Chief H. H. Bennett had some training in geology having been made aware of the soil survey work in USDA by Collier Cobb, his geology professor at the University of North Carolina. It was not until the establishment of the Engineering and Watershed Planning

Units in 1954 that the discipline was formally recognized. Each E&WP Unit had an engineering geologist on the staff and the states added geologists to their staffs as the need dictated. The importance of their contribution became more generally acknowledged in all phases, i.e. preliminary examination, planning and operation. Handbook guidance for the procedures in making geological investigations and sampling for analysis was issued in 1963 and additional technical information on the description of materials and exploration methods and equipment was issued soon thereafter.

SCS engineering geologists actively participate in professional organizations dedicated toward the perfection of their science and procedures. They have contributed to the knowledge and utilized the experience of other agencies and individuals to bring the most modern methods to field operations.

Soil Mechanics

With the varying physical properties of the earth materials used in SCS construction, SCS engineers early recognized the need to identify and characterize their physical properties. The advent of the flood control and watershed protection projects prompted the establishment of small soil mechanics laboratories to assist with the analysis and provide design criteria on complex dam sites. Early laboratories were located at the E&WP Units at Spartanburg, SC, Albuquerque, NM, and Portland, OR.

About 1954, the Soil Mechanics Laboratory in Albuquerque was moved to Lincoln, NE, and the National Soil Mechanics Unit was established with Rey Decker as the head. The Soil Mechanics Unit worked closely with the State Conservation Engineers and the E&WP Unit Design Engineers in establishing procedures for sampling sites proposed for earth dams and channels. Soil samples were forwarded to the Lincoln laboratory for testing and the preparation of recommendations pertaining to their intended use. As more and more data on soil materials were accumulated, the laboratory was able to develop helpful correlations to perfect the design process. Criteria for sampling underwent continuous evaluation and improvements were made reducing the cost of the site investigation and improving the quality of the data. The recommendations prepared for specific sites included a stability analysis for consideration by the design engineer.

Additional soil analysis was continued at the Fort Worth and Portland Technical Centers as the work load dictated. Coordination of the technical procedures was accomplished by the Washington office staff soil mechanics engineer. Depending upon the work load and complexity of the work, some states added soil mechanics engineers to their state engineering staffs.

A particular contribution that was made by SCS soil mechanic engineers was the work done in identifying and determining the properties of dispersed soils. These problem materials have long posed serious stability and erosion problems and the contribution of SCS engineers Loren Dunnigan and James Talbot and consultant James Sherard has been recognized by the profession through the presentation of the prestigious Normal Medal by the American Society of Civil Engineers for the paper "Filters for Silts and Clays."

Sedimentation Geology

Sedimentation studies have always been important to the work of the Soil Conservation Service, and from the very first, sedimentation geologists were attached to the technical staffs. Much of the knowledge of sedimentation as well as its application to the planning and operational phases of the SCS program was relatively new. The sedimentation geologist has the responsibility to determine the effects of sediment on SCS programs and conversely, the effect of SCS programs on the sediment yield.

Reservoir sedimentation surveys received much attention since they provided basic data. When analyzed, the information could be projected for estimates at other proposed impoundment sites. Early work by Henry M. Eakin and Carl B. Brown was important in establishing procedures, and during the period that SCS was authorized to conduct research, considerable attention was given to the further development of equipment and survey methods.

The advent of new programs of flood prevention and water resource development gave extra emphasis to the need for more refined estimates. Additional attention was given to the conduct of reservoir sedimentation surveys and the correlation of the results with the geologic, topographic, climatic, land use and vegetative characteristics of the watershed.

The Agricultural Research Service and U.S. Geological Survey have important responsibilities associated with sediment studies. The Corps of Engineers and the USDI Bureau of Reclamation also have interests in sedimentation processes and estimates. These and other federal agencies cooperated in the studies, and Federal Inter-Agency Sedimentation Conferences provide valuable technical exchange.

SCS sedimentation geologists continue to associate information from measurement of erosion, suspended sediment loads, and the measurement of the volumes deposited in the reservoirs to improve their knowledge of sediment delivery ratios and trap efficiencies in reservoirs.

Another important function of the sedimentation geologist is the conduct of flood plain damage surveys. Here they utilize their knowledge of sediment properties and productivity and patterns of deposition to evaluate damages resulting from infertile deposition, swamping, scour, and effects on stream channels. Here again, the conduct of damage surveys provides a base for the development of procedures leading to continued refinements and precision.

Structural Engineering

Traditionally, engineers have had the responsibility for the design and construction of permanent structures. The functional requirements of conservation systems required the development of new types of structures with unique problems. Difficult site conditions often required special solutions. Insofar as possible, site investigations established the criteria for the design--often especially established for the individual structure. In other instances, standard plans were adequate when modified for size and capacity.

With the establishment of electronic communication and data transfer and the harnessing of the power of computers, designs can now be quickly adapted for

site conditions and made available to state and field offices. As the software programs and computer hardware are improved, the potential for improved structural design is great.

Landscape Architecture

The beauty of a well tended agricultural landscape has long been recognized. Early in the 1900's, USDA's Extension Service encouraged landscaping rural homesteads.

The deterioration of the rural landscape, most apparent during the decade of the thirties, was widely noticed. The causes of this deterioration were often attributed to the marginal income of the farm community as "there is little incentive for farm families to invest in the appearance of farmsteads and farms when foreclosure or sale is just around the corner." Equally important was the ugliness of the eroded and gullied lands that became more widely recognized. The application of conservation practices, especially contour farming, strip cropping and terracing, as well as the improvement of grasslands and timber tracts did much to improve the rural scene and was quickly noted and appreciated by a wider audience. In the 1960's, SCS assembled a series of color photographs, one from each state, entitled "America the Beautiful." This series was highly acclaimed and was widely exhibited. Among the many places where the full series was exhibited and observed by the author were the International Agricultural Exhibit at Cairo, Egypt, Dulles Airport at Washington, DC, and the U.S. Embassy in New Delhi, India. Many companies and individuals selected favorites for use in their offices and homes. Probably the impact of this series has not been fully appreciated.

In 1965 President Johnson, with the strong supporting interest of Lady Bird Johnson, the First Lady, assigned Secretary of Agriculture Orville Freeman the responsibility for Federal leadership for beautification on privately owned rural lands. SCS was given an important role since natural beauty is a normal product of effective soil and water conservation practices. The Resource Conservation and Development projects together with the pilot and P.L. 566 flood control projects gave even more opportunities for incorporating visual composition in the design of works of improvement.

Though it has been reported that landscape architects were on the staff when the agency was created, it was not until 1971 that a landscape architect was added to the staff of the Engineering Division and later supplemented with staff positions in the regions and states. Originally the primary purpose was to enhance the beauty surrounding major water resource structures including related recreation facilities. As appreciation of the benefits grew among the SCS staff and district officials, more attention to the visual aspects was included and environmental design is now incorporated in the day-to-day conservation activities.

Environmental Engineering

Environmental concerns were largely responsible for the establishment of the Soil Conservation Service. The dust storms of the early 1930's dramatically demanded the attention of the nation and the Congress. The depreciation of the agricultural resource finally became recognized and the initial effort was the control of wind and water erosion. These measures had considerable related

beneficial impact through the improvement of landscape features, i.e., improvement of cultivated areas, grasslands, and forests. The impacts on fish and wildlife by the improved coverand water impondments were also significant.

SCS engineers provided considerable data to the newly formed Environmental Protection Agency (EPA) when it was first established and faced with the task to rapidly initiate techniques and standards.

Since SCS is the water agency within the Department of Agriculture, SCS engineers have long been concerned with its quality, its conservation, and its disposal. Therefore they were in an excellent position to provide leadership when agricultural waste disposal became a national concern. Similarly, they have had an impact on the programs to preserve groundwater quality and agricultural chemical control.

Computer Modeling and Software

From the advent of electronic data processing equipment, SCS engineers have recognized their potential in reducing planning time and cost. The small programmable electronic calculators came into widespread use and often permitted designs to be completed in the field without extra trips to the office. Many field engineers developed their own programs adapted to their special conditions.

When hydrology and hydraulic modeling were needed to design watershed projects, the capabilities of computers were apparent. About 1954 both the CTU and DU were working on software to reduce costs and improve quality in planning and design. In 1958 a program for determining water surface profiles was introduced. Complex hydrology programs were developed through contracts proposed and monitored by the SCS staff. Improvements in communications and data transmission capability between the design and field offices made the developments even more useful.

In 1984 the Engineering Division established the Engineering Software Work Group to develop a plan for automating engineering design and construction drawings in the 3,000 SCS field offices. The plan was approved in June 1987 and software development of Field Office Engineering Software (FOES) began with a projected completion date of 1993. FOES is considered to be the largest software effort ever undertaken by SCS. The activities include 13 teams of SCS technical staff, involving about 80 employees representing the National Headquarters, National Technical Centers, and state staffs.

SCS has always been a production oriented organization. Because of this, it has not been easy to commit staff and time to the maintenance of technical materials. During the mid 1980's, the acceleration of software development has produced the policy that all nationally developed SCS software would be maintained through specifically assigned staff responsibilities. Leadership will be provided by the discipline leaders and the National Engineering Technology Development and Maintenance Staff. It will be a challenge to budget sufficient staff resources on a continuing basis to properly maintain the Service's software.

DEVELOPMENT OF ENGINEERING APPLICATIONS FOR SCS PROGRAMS

Erosion Control

Soil erosion control was the first and principal interest of the newly organized Soil Conservation Service. Techniques for the installation of terraces and gully control devices were known to professionals, but even the need for such measures was not recognized by the general farm community. A number of demonstrations had been installed by the Extension Service and the agricultural colleges, but in many areas the practices had not caught on. The drought of the 1930's combined with some extreme rainfall events did much to gain attention. The demonstration projects and ECW camps together with the educational activities of the Extension Service generated interest. Many farmers first agreed to conservation measures not so much because they were concerned about soil loss, but because the heavy rains washed out their newly planted crops and the washes and gullies that formed in the fields interfered with their farming practices.

A prime need for the implementation of a successful erosion control program was the development of machinery for farm use that overcame the problems the farmer met in adopting conservation measures. For many years the SCS Engineering Division had a staff member who worked with agricultural colleges and machinery manufacturers to encourage the development of needed equipment for both farm operations and construction. This task is now mostly done by the private equipment manufacturers.

In some areas strip cropping and contour farming combined with vegetative practices gave adequate protection. On these sites, engineering skills were needed for planning and layout.

Many farmers resisted terraces since the conventional measure of a good farmer was the straightness of his furrows. Farmers generally would first accept contour farming and later when they found that some reinforcement was needed, they accepted the need for terraces. Many still farmed with horses or small tractors and power for on-farm terracing was limited. For awhile there was great interest in "plow" terraces since the farmer could build these with his own equipment. However in most instances they were not built to the necessary height and frequently had very crooked alignments.

As contractors equipped with better machinery became available, much of the terracing work was more adequately constructed and alignments were improved to ease farm operation. Continued progress and availability of earth-moving equipment permitted gradual acceptance of parallel terraces and bench leveling.

Except in areas with permeable soils, a water disposal system was needed to convey the runoff from the terraces to a lower stable channel. Some of the early demonstrations relied on drop structures but it was soon apparent that in most instances, well shaped vegetative channels were adequate, could be installed at lower cost, and were more acceptable to the farmer. The flow characteristics of vegetated waterways carried high priority for research and the procedures developed by SCS have received worldwide acceptance.

As the size of farming equipment increased, there was more pressure to eliminate turnarounds and to utilize all the area available for cultivated crops. The use of herbicides sometimes destroyed the vegetated waterways and an alternate outlet design was needed. Increased attention was given to land forming to provide smooth contours as nearly parallel as practical and the installation of parallel terraces with buried pipe drainage outlets. The temporary storage capacity of the terraces was used to reduce the peak flow, thereby reducing the size of the pipe needed and allowing additional infiltration in the terrace channel because of the longer period of ponding.

Gullies have always been a great concern in the farm community and their rapid advancement led many farmers into the conservation movement. Here again many of the early methods relied on structural control until the possibilities of some vegetative measures were noted. Brush dams and diversions were early popular mechanical measures--now largely supplanted by vegetative control. Drop structures, drop inlets, and chutes are still required to control difficult sites.

Farm ponds have always been a principal measure involving engineers. Progress over the years has included the improvement in site selection, better runoff prediction, the use of trickle tubes and temporary detention storage to reduce flow through earth spillways, and improved construction standards and inspections.

Irrigation

When SCS was authorized to assist farmers with their irrigation problems in 1938, many SCS engineers, having a strong farm background and having been educated in western colleges, had a good working knowledge of irrigation methods. And in 1939, strong leadership in the technical field was provided by the transfer of research personnel from the Bureau of Agricultural Engineering. In 1939, a Division of Farm Irrigation in the Washington office was established and W. W. McLaughlin, long-time chief of the BAE, was appointed director. In 1942 though still assigned to the Washington Office, his headquarters were established at Berkeley, CA. In 1940, he reported that the principal lines of investigation included: irrigation requirements, evaporation studies, spreading water for storage underground, rainfall disposal, snow surveying, alkali reclamation, conveyance of water, design and invention of irrigation apparatus, laws, customs and regulations, and the engineering and economic feasibility of irrigation enterprises. His division remained in the research group but the close association had its influence on operations programs. The first regional irrigation engineers were located in the West and as the practice moved eastward, they were gradually added to the staffs of other regions.

In 1946, Dr. McLaughlin was succeeded by George D. Clyde, previously Dean of the School of Engineering and Technology, Utah State University, and his headquarters were transferred to Logan, Utah. Dr. Clyde was a strong advocate of close relations between research and operations and in April 1952, he and his assistant, Wayne D. Criddle, promoted and attended a conference of the regional irrigation engineers at Albuquerque, NM. At that time, Tyler Quackenbush was the Irrigation Engineer on the Washington staff and there were irrigation engineers in the regional engineering divisions at

Spartanburg, SC; Fort Worth, TX; Lincoln, NE; Albuquerque, NM; and Portland, OR. This was the first national meeting of any of the engineering specialists from the regions. The conference served to bring field problems to the attention of the research personnel and to establish the first tentative steps to prepare standards for irrigation practices. Later the Washington and regional irrigation engineers were included in the national meetings of the SCS research staff and as a result, close relationships developed. Dr. Clyde regarded the field operations of SCS as the largest and most practical laboratory that ever existed to study irrigation. Research personnel assisted in training meetings for state staffs and were available for consultation and help with difficult technical problems.

An example of the latter was a problem on the Eden Valley Wheeler Case project on which SCS had development responsibility. The Bureau of Reclamation had classified a large area of very sandy land as irrigable and SCS was obligated to prepare it for sale to veterans. Since surface irrigation was not practical and sprinklers could not be economically justified, a joint study came up with a subirrigation design which was successfully applied.

In 1954 the transfer of research activities to ARS largely ended this close interaction, though the transferred personnel without exception continued close informal relationships and cooperation. The success of the early collaboration continues to influence relationships between SCS and ARS.

Drainage

Until 1938, SCS was not authorized to do drainage work. However for a number of years the USDA BAE had been conducting research on drainage problems. On June 25, 1935, the first CCC drainage camp was authorized and was administered by the BAE. During the next few months a total of 46 drainage camps were established in the southern and eastern states. These camps were authorized to rehabilitate main drainage canals serving districts or groups and provide adequate outlets for the private lands. No work was performed on private lands. S. H. McCrory was Chief of the Bureau, and L. A. Jones was Chief of the Division of Drainage. John G. Sutton, later the SCS chief drainage engineer, was district engineer for the BAE at that time and supervised 36 of these camps.

Thirty-eight of these CCC drainage camps were transferred to SCS on July 1, 1939, and in 1941 drainage was approved as a conservation practice to be included in conservation farm plans. Drainage activities were further expanded by the Flood Control Act of 1944 and the Federal Watershed Protection and Flood Prevention Act of 1954.

As irrigated areas continued to expand and flood control projects came into being, drainage technology became more and more important in the planning and application stages. SCS drainage engineers were recognized leaders and the drainage handbook they prepared became an important document used throughout the profession. In 1972 this handbook was reprinted in its entirety by the Water Information Center, Inc., "to make it available to all persons and organizations interested in the management of water resources for the benefit of man."

Flood Control and Soil and Water Resource Development

The Watershed Protection and Flood Prevention Act further expanded the engineering responsibilities and established the Soil Conservation Service as a major agency in the protection and development of small watersheds.

Suddenly, planning engineers were needed to conduct engineering preliminary examinations and meet with other professionals to prepare plans that met the objectives of the local sponsoring organization. Hydrologists and hydraulic engineers, geologists, sedimentationists, agricultural engineers, and others worked with other professionals in studying alternative approaches to the problems. Watershed plans had to be prepared which would permit evaluation by Congressional committees to authorize funds for construction.

These programs plus the river basin studies, flood hazard analysis, flood insurance studies, and the later organized Resource Conservation and Development (RC&D) program were administered by the Watershed Projects Division which had on their staffs a number of engineers to facilitate program operations. The detailed design and construction remained the responsibility of the Engineering Division.

Design engineers were involved with developing plans and specifications for complex structures of a size not previously constructed by SCS. Construction engineers carried greater responsibilities in inspection and documentation as well as involvement in safety and providing quantity of work data for contractor payments.

In the 1950's when hydrology and hydraulic modeling were needed to design watershed projects, SCS engineers provided leadership in computer modeling.

Water Quality

In the late 1980's, the Department of Agriculture and SCS developed policies involving water quality and quantity for both surface and ground water.

Environmental engineers and geologists initially provided leadership in addressing the issue. However, it was quickly recognized that the involvement of drainage and irrigation engineers was essential. As the program developed it became apparent that all of the engineering disciplines are needed in the planning, structure design, construction, and operation and maintenance. The key for the future is how to implement this program at the field level.

The 1985 Farm Bill

The 1985 Farm Bill included provisions that required farmers to develop plans to reduce erosion on highly erosive croplands and to protect existing wetlands.

Many professionals believed engineering staff involvement would be minimal because most work involved conservation planning, management practices, and followup. As implementation proceeded, it became obvious that low initial cost engineering practices were essential to the program and assistance from agricultural engineers and other engineering disciplines was needed. In addition, the wetland issue required accelerated engineering training of the staffs at the state, area, and field office levels.

DEVELOPMENT OF ENGINEERING MANAGEMENT

The overall management of an engineering project involves the planning, design, construction, operation, and maintenance of the facility.

Design

The design function is a composite of all the engineering specialties in that it utilizes the expertise of all of the applicable fields to produce an engineering design that meets the requirements of a plan. In SCS, the design engineers have a special responsibility to develop effective, durable, economical, and safe hydraulic structural plans that will meet the conservation objective.

In the early days of the Service, the design responsibility was in the hands of the field engineers since at that time, structural works were of a relatively simple type well within their capabilities. As described earlier, when unusual structures were required, the design was approved by a more experienced engineer. The first design engineers were attached to a few of the erosion control projects and the early regional engineering divisions. The specialty received additional recognition with the initiation of the Engineering Standards Unit in 1949.

As programs for water development and conservation became more and more complex, the design function grew in importance and design problems arose for which there were not conventional solutions. Especially in the area of hydraulics, problems were encountered that required ingenious approaches that needed to be verified through research and field trials prior to adoption in important structures. Fortunately the relationships that had developed between research and operations personnel when SCS had some research responsibility continued. Collaborative efforts led to successful results.

Engineers always realized that a more conservative design was required for large dams as compared to small farm ponds and in the 1950's a classification system was first proposed, based upon the potential for downstream damage should the dam fail. The hazard class system that was eventually developed by SCS has been widely adopted by the profession. It was incorporated unchanged in the Corps of Engineers 1974 guidelines for inspection of nonfederal dams. Different private and government organizations have modified the system somewhat but the basic principles are still in use.

One concept pioneered by SCS was the use of earth spillways on important storage structures. From the very beginning of SCS, earth spillways were used on small farm ponds. Most were satisfactory but with larger drainage areas, some spillway erosion was experienced because of the prolonged flow. The first approach to this problem was to install "trickle tubes" or primary structural outlets that had a limited flow capacity but utilized some of the storage capacity of the reservoir to reduce the frequency of flow through the earth spillway. Field experience from the hundreds of thousands of earth spillways built by SCS led to increased confidence in their practicability for successfully handling infrequent flows. Field experience provided increasingly refined design. The principle of limiting flow volume (flow duration and magnitude) provided assurance of maximum

performance without the danger of breaching. Consideration of the frequency of operation and stability evaluation for infrequent storm occurrence provided for a reasonable risk of maintenance level. The majority of the flood control dams constructed by SCS could not have been economically justified without dependence on earth spillways to convey large infrequent flows.

Drop inlets have been widely used by SCS for erosion control in cases where vegetative measures would not be effective. The "standard" design had an open vertical riser connected to a horizontal pipe or monolithic outlet. Some of these were found to be dangerous and a few reports of fatalities when people were being caught and washed through these structures created concern. The size of the inlets being constructed also increased and it was obvious that some sort of a safer design was needed. Safety fences around or racks installed over the inlets collected trash and interfered with flow. The development of a covered top inlet for risers on conduit spillways is an excellent example of collaboration between research and operations. The design was originally conceived by the SCS design staff and the hydraulic elements were tested and refined by the St. Anthony Falls Hydraulic Laboratory. The design assumptions to prevent clogging by trash were verified and refined by the Outdoor Hydraulic Laboratory at Stillwater, OK.

Industry too cooperated in the development of solutions of problems that arose. Special note should be made of the cooperation of the American Concrete Pipe Association in producing reinforced concrete pressure pipe with a special gasketed joint that provided the extensibility and watertightness required for conduits in SCS dams built on yielding foundations. Metal pipe manufacturers produced special appurtenances and fittings (inlet riser fittings, watertight couplers, antiseep collars, etc.) that were needed for certain classes of SCS dams.

The advent of computers in some respects revolutionized SCS design, in that it permitted consideration and evaluation of many more optional solutions and provided a means for rapid completion of the design. A catalog of standard drawings for structural components has provided a rapid source of construction drawings meeting common needs.

Construction

Some of the engineers assigned to equipment supervision in the early days were in reality the predecessors of the present construction engineers. Heavy construction equipment was not commonly available and the government acquired a considerable amount of earth-moving equipment, tractors, drag lines, etc., to facilitate the work in the projects and CCC camps. To utilize the labor force available, transportation equipment and supplies of construction equipment and tools had to be provided and maintained. Training of operators and the conduct of safety programs were also important.

Until SCS became involved in major construction works required by the flood control and watershed protection and RC&D projects, construction inspection could be carried out by the field engineers attached to the projects, CCC Camps and soil conservation districts. Only spot checks were necessary to assure quality and adherence to the plan

on the early works that were constructed by the farmers or local contractors hired by the farmers.

As larger and more complex structures were encountered and the construction done by contract, it became necessary to develop a cadre of construction inspectors with facilities to make construction surveys, sample and test construction materials, enforce safety requirements, assure that contract specifications are met, and to report the quantities of work performed for payment. Generally the contracts were let by local sponsoring organizations. Depending upon local conditions and the desires and competence of the sponsors, there have been a number of different arrangements for conducting the work. Usually an SCS inspector had the total responsibility or supervised or spot checked the work of inspectors provided by the sponsoring organization.

Together with other flood control and resource conservation and development programs, the number of dams constructed by the SCS under project activities now exceeds 10,000.

Operation and Maintenance

The responsibility for operation and maintenance of engineering structures installed with the help of the SCS lies with the land owner or project sponsors. They are subject to state laws regarding inspections, maintenance and repair as they apply to important works. SCS engineers assist project sponsors in developing operation and maintenance plans and as requested, in providing technical advice on specific problems.

Because of the large number of high-hazard dams constructed with SCS engineering assistance, the staff has always felt a responsibility to take an active role in promoting programs to insure the safety of downstream interests. When dam safety became a national concern in the 1970's, SCS engineers cooperated with the Corps of Engineers, the Bureau of Reclamation, state authorities, and private organizations in developing an inventory of large dams and a recommended procedure for a national inspection program.

It is recognized that there are a great many dams in the United States that need rehabilitation and modification to meet current dam safety standards. Only the very highest priority high-hazard dams are being updated because of the lack of funds available to the owners and sponsors. If funding became available, the work load of the SCS staff in providing technical assistance to the sponsors in rehabilitating this important part of the nation's infrastructure would be tremendous.

Presently, the SCS state staff spends considerable time in assuring that dams continue to be safe and in evaluating alternatives when it is judged that repairs are needed. In 1983, SCS policy required that all future high-hazard dams include an Emergency Action Plan (EAP). This plan must be completed by the sponsor prior to the construction of the dam.

In the 1980's, the Association of State Dam Safety Officials (ASDSO) was organized and developed into the leading dam safety advocate for state dam safety legislation and programs. In 1988, the SCS Engineering Division brought to the attention of the ASDSO that the EAP's for many high-hazard dams were not kept up to date and were not being reviewed and tested. State and

Federal agencies agreed that this was a major problem and neededaction. Efforts were initiated by SCS to involve ASDSO with SCS state staffs in encouraging sponsors to update and test their EAP's. In addition, all sponsors of SCS-assisted projects were encouraged to develop and EAP for any high-hazard dam constructed prior to 1983.

At their 1989 annual conference in Albuquerque, the ASDSO presented the ASDSO National Award of Merit to Donald L. Basinger, Director, Engineering Division, SCS, for leadership in dam safety. The president of ASDSO stated,

> *through the SCS's successful national dam safety program and its work with ASDSO, dam safety in the United States is on the rise.*

SCS LEADERSHIP IN THE ENGINEERING PROFESSION

USDA-SCS has the responsibility for a national program for soil and water conservation. As priorities and programs change, engineers will continue to be vital to all soil and water conservation activities.

SCS engineers and geologists have continually exhibited leadership in their specialized fields and have maintained relationships with other professional organizations and societies to advance the technology and practice. Some examples are:

Consensus Standards

For many years SCS has developed standards and specifications for all the engineering conservation practices and has worked with various professional societies and commercial organizations to assure state-of-the-art practice. Each specification is updated often. Since 1964, SCS engineers have been in the lead and have directed the use of ASTM (American Society for Testing Materials) standards for all SCS engineering work instead of the still available federal standards. In 1968, the Federal Government encouraged the use of consensus industry standards for use by all agencies.

In the 1980's, the SCS engineering staff at the National Headquarters and the four NTC's made major contributions in developing ASTM standards through leadership on ASTM committees. In addition to consensus standards for materials, SCS engineers have been working with technical and professional societies to establish consensus technical standards for systems of soil and water conservation measures. The goal is to have Federal-state standards and specifications for all conservation practices that will be acceptable to all groups.

Technical Materials

SCS engineering handbooks, technical releases, and notes are being used worldwide. Many requests for these materials come from students and individuals, from libraries and other agencies, and from foreign governments and international offices. Traditionally, requests have come to and were filled by state offices, the Engineering Division, the Information Division or Central Supply. Because of the great demand for these materials, a change in the distribution system was necessary. Now most technical materials are sold by the National Technical Information Service in Springfield, VA. Some complimentary copies are provided by SCS offices as the circumstances dictate.

Currently the Engineering Division is participating with about 15 countries in an international effort with the Food and Agricultural Organization (FAO) of the United Nations (UN) to collect and share technical materials with developing countries. The effort is called Inventory of Proven Operational Technology (IPOT). It has great potential to expedite U.S. Agency for International Development and World Bank projects by reducing the duplication of development of technical materials for their projects worldwide.

SCS has planned and installed more earthfill dams and vegetated emergency spillways than any organization in the world. With this experience came a recognized responsibility to develop and share new cost-effective technology for these dams and emergency spillways. Some recent innovations include:

Sand and Gravel Filter Criteria

Over the years much has been learned about the mechanics of failure in earthfill dams. One of the most significant improvements in design has been the development of filter criteria to protect against all types of cracking and seepage. With the leadership of SCS engineers, these criteria have been included in the ASTM standards for the entire engineering and construction community.

Filter Diaphragms

Traditional design to prevent seepage along principal spillway conduits has been to install impervious rigid collars around the conduits. However, observations at many site have shown significant deficiencies associated with rigid collars, especially those made of reinforced concrete. In 1984, SCS developed and implemented a new design to replace the rigid collars with filter diaphragms composed of sands and gravels. This new filter diaphragm intercepts and safely conveys any seepage that might occur along the principal spillway to a suitable outlet. It is probable that this innovation will gain acceptance in the engineering profession worldwide as a major improvement in the design of small earthfill dams.

Spillway Studies

Because of the large number of dams designed and constructed by SCS, there are many emergency spillway discharge events from major storms over the nation. Many opportunities exist to study the damage resulting from major flows in these spillways. SCS began observing, recording and analyzing these events in the 1960's, and major improvements in emergency spillway layout and design in both earth and rock spillways are being made. The intention is to report these improvements to the engineering profession through technical papers presented and published for peer comments and reference.

In addition, special studies are being made of principal spillway conduit materials, which will lead to improved life of projects. The studies have focused on projects in Kansas and surrounding states because of the large number of project dams available for study.

SOME PERSONAL OBSERVATIONS

One of the most attractive features to young engineers employed by the Soil Conservation Service is the opportunity to visualize a project, prepare or assist with its design, supervise construction, and finally have the opportunity to see and evaluate the finished product. They need not be constrained to only one part of the process.

It is a mistake to associate certain disciplines with certain programs. The team approach has been proven successful. All disciplines should be a part of the team responsible for policy, planning, implementation, and evaluation.

SCS has a national engineering delivery system to be envied. Whereas, many Federal and private sector organizations have regional and branch offices that are autonomous, the SCS system promotes uniform engineering quality, minimizes duplication of efforts, and shares tools and techniques nationwide.

It is also gratifying that the engineering organization provides a great deal of training and support to the technical staffs. Whenever a difficult technical problem is encountered, it can be referred to peers or upward in the organization for advice and assistance. The numbers and varied experience of the engineering personnel can usually provide the needed guidance. In the rare instance when this is not possible, SCS is prepared to refer the problem to research institutions and commercial companies for solution or establishing the state of the art.

The loss of the research function in 1953 had an adverse effect on the rapid perfection of new engineering techniques. When research and operations personnel were closely associated, problems could immediately be addressed and priorities established. The close working relationship which had developed between research and operations personnel continued for some time after their separation (especially with the researchers who had been with SCS) and though efforts to continue these personal associations have been made, the effectiveness of the system declined somewhat. However, an example of close collaboration between SCS and ARS engineers is the working relationship developed on top priority soil erosion and water quality models.

The Service should give more encouragement to all engineering personnel throughout the organization to actively participate in professional societies. Of course, this carries the corresponding responsibility to prepare and present technical papers. It is of interest to note that in 1989 Soil and Water Transactions of the American Society of Agricultural Engineers, the SCS was barely represented. Of the 136 papers published, only two SCS employees had contributed. Participation in technical societies not only provides the opportunity for professionals to keep on the cutting edge of their technology but also brings the technical excellence of SCS to the attention of other professionals in both the private and public sector. The personal relationships acquired through participation pay great dividends in cooperative efforts and assure SCS of a strong voice in promoting its programs.

There have been periods in the past when policy did not permit the names of the authors of technical publications, papers,

and handbooks to be noted. As a result, many technical developments conceived and perfected by SCS engineers have been rewritten and presented by others. With the passage of time, these other individuals become recognized for work that properly should have been credited to an SCS engineer or group. It is strongly recommended that reports of engineering techniques and processes developed by Service engineers carry acknowledgement for the individual or groups that participated in its preparation.

Maintaining qualified area engineering staffs is highly cost effective. This is especially true as the service is faced with implementation of programs such as RC&D, 1985 Farm Bill, and technical assistance on water quality and quantity, without additional field office staff. Much of the demand for complex technical engineering assistance to local units of government can most effectively be handled by engineers located at the area office level.

Literature Cited

1. *Century of Service, the First 100 Years of the United States Department of Agriculture.* Centennial Committees, USDA.

2. Activities of the Division of Irrigation, 1940. E. W. McLaughlin, Chief, Division of Irrigation, SCS.

3. *Yearbook of Agriculture, 1930.* pp. 178-179.

4. *Soil Erosion: A National Menace.* Hugh H. Bennett and W. R. Chapine. April 1928.

5. *A Chronological History of the Soil Conservation Service and Related Events.* Robert L. Geiger, Jr. SCS-C1, December 1955.

6. Summary Annual Report of the Soil Erosion Service for the Fiscal Year Ending June 30, 1940.

7. *Technical Workers in the Department of Agriculture and Outline of Department Functions.* 1935. USDA Miscellaneous Publication No. 233.

8. *Congressional Directory.* January 1936. p. 334.

9. H. H. Bennett. *Soil Conservation.* April 1941. p. 263.

10. "Land Utilization--Past--Present--Future," E. G. Grest and W. F. Dickson. *Soil Conservation,* January 1945. p. 147.

11. *Congressional Directory.* June 1940. p. 354.

12. *Congressional Directory.* February 1954. p. 435.

13. USDA Engineering Memorandum SCS-4, dated June 8, 1954.

14. "Agriculture and the Landscape," Marion S. Monk, Jr. *Soil Conservation*, August 1965. pp. 19-20.

15. Statement to Enrollees. First Anniversary of CCC Drainage Camps. John G. Sutton. 1936.

16. *Farm Drainage in the United States.* 1987. USDA Miscellaneous Publication No. 1455.

17. "SCDA-SCS: Engineering for the Future," Donald L. Basinger. *Agricultural Engineering.* April 1985. p. 27.

References

Ackerman, Wm. C.	"On Doing Watershed Research." *Soil Conservation,* March 1955 .
Allis, John A. Kelly, Ludwig L.	"Runoff from Small Watersheds." *Soil Conservation,* February 1958.
Andrews, R. G.	"Hydrology in Soil and Water Conservation." *Soil Conservation,* July 1959.
Buie, Eugene C.	*A History of United States Department of Agriculture Water Resource Activities.* Mimeo. September 1979.
Clyde, George D.	"White Gold." *Soil Conservation,* April 1953.
Criddle, Wayne D.	Personal Communication, August 30, 1989.
Grant, Kenneth E.	"RC&D - The Can-do Projects." *Soil Conservation*, February 1969.
Grest, E. G.	"Land Utilization, Past-Present-Future." *Soil Conservation*, January 1945.
Elliott, C. E.	*Farm Drainage*. USDA Farmers Bulletin #40. June 1986.
Grest, E. G.	"Management of Lands Held Under Title III of the Bankhead-Jones Farm Tenant Act." *Soil Conservation*, February 1940.
Hardin, Charles	*The Politics of Agriculture: Soil Conservation and the Struggle for Power in Rural America.* The Free Press, Glencoe, IL.
Hartley, C. P.	"Means of Preventing Soil Washing." *Yearbook of Agriculture, 1903*. pp. 178-179.
Helms, J. Douglas	"The Soil Conservation Service: A Historical Overview." *Agricultural Engineering*, April 1985. p. 22.
Helms, J. Douglas Flader, Susan L.	*Agricultural History.* Symposium, Univ. of Missouri, May 23-26, 1984.

Helms, J. Douglas	"The Civilian Conservation Corps Demonstrating the Value of Soil Conservation." *The Journal of Soil and Water Conservation*, Vol 40, No 2. 1985.
Helms, J. Douglas	*Small Watershed and the USDA: Legacy of the Flood Control Act of 1936.* Proc. of Nat. Symposium, Public Works Historical Society. 1988.
Helms, J. Douglas	"Conserving the Plains: The Soil Conservation Service in the Great Plains." Mimeo. *USDA in Historical Perspective,* Ames, IA, June 15, 1989.
Holtan, H. N. Kirkpatrick, M.H., Jr.	"Rainfall, Infiltration and Hydraulics of Flow in Runoff Computations. *Transactions American Geophysical Union,* 31:771-779. 1950.
McConnell, O. E.	"Old West Lives Again in LU Projects. *Soil Conservation,* June 1945.
McCornuck, E. B.	"How Engineering May Help Farm Life." *Yearbook of Agriculture, 1915.* pp. 101-112.
McCrory, S. H.	"The Drainage Movement in the United States." *Yearbook of Agriculture, 1918.* pp. 137-144.
McGee, W. J.	"The Agricultural Duty of Water." *Yearbook of Agriculture, 1910.* pp. 169-176.
McLaughlin, W. W.	Activities of the Division of Irrigation. Mimeo. C.1940.
Mitchelson, A. T.	"Irrigation Water Supply Increased by Storing Flood Water Underground." *Yearbook of Agriculture, 1931.* pp. 331-334.
Mulford, F. L.	"Extension Work in Landscape Gardening as Conducted by the Federal Departemnt of Agriculture." *Landscape Architecture,* January 1922. p. 65
Mustgrave, G. W.	Comparison of Methods of Measuring Infiltration. SCS unpublished research. 1953.
Myer, Dillon S.	"Water Facilities for the Arid and Semiarid West." *Soil Conservation*, July 1938.
Myer, Dillon S. Gray, L. C.	"Water Facilities and Land Use in Drier Areas." *Soil Conservation,* August 1938.

Newell, Frederick H. "Irrigation on the Great Plains." *Yearbook of Agriculture, 1896.* pp. 167-196.

Nichols, M. L.
Chambers, T. B. "Mechanical Measures of Erosion Control. *Yearbook of Agriculture, 1938.* pp. 646-665.

Ogrosky, H. O. "Electronic Computers Join SCS Team in Planning for Watershed Protection." *Soil Conservation,* June 1964.

Parshall, R. C. "The Improved Venturi Flume." *Transactions ASCE,* vol 89. 1926.

Phelan, John T. "50 Years of Agricultural Engineering within USDA-SCS." *Agricultural Engineering*, April 1985. p. 24.

Ramser, C. E. "Terrace Failures Often Result from Errors in Planning and Building." *Yearbook of Agriculture, 1931.* pp. 508-512.

Ramser, C. E. "Gullied Land Reclaimed by the Use of Brush Followed by Terracing." *Yearbook of Agriculture, 1931.* pp. 279-281.

Ramser, C. E. Resume of Outstanding Research Contributions Made During the Last Twenty-Five Years. Mimeo. C.1932.

Schauman, Sally *The State of Federal Design: Landscape Architecture.* April 1989.

Scoby, F. C. *The Flow of Water in Concrete Pipe.* USDA Agricultural Bulletin 852. 1920.

Scoby, F. C. *The Flow of Water in Wood Stave Pipe.* USDA Bulletin 376. 1916. Revised 1926.

Scofield, Carl S. "Alkali in Irrigated Districts." *Yearbook of Agriculture, 1926.* pp. 142-145.

Shannon, W. G. "Electronic Methods of Snow Surveying." *Soil Conservation,* December 1966.

Shannon, W. G. "Modernizing Snow Surveys." *Soil Conservation,* May 1959.

Smith, Frank E. — *Conservation in the United States, Land and Water 1900-1970*.

Stafford, H. M. — *History of Snow Surveying in the West.* Mimeo. Western Snow Conference, Reno, NV, April 21, 1959.

Talbot, James R. — Short History of Soil Testing at Portland. Mimeo. 1974.

Thiessen, Alfred H. — "The Value of Snow Surveys as Related to Irrigation Projects." *Yearbook of Agriculture, 1911*. pp. 391-396.

Thornthwaite, C. W. — *Measurement of Evaporation from Land and Water Surfaces.* USDA Technical Bulletin #817. 1942.

U.S. Congress — Congressional Directory, 1933 through 1956.

Unidentified — History of Land Drainage Activities of the Soil Conservation Service.

USDA — *Technical Workers in Department of Agriculture.* Misc. Publlication No. 233. 1935.

USDA — *A History of Federal Water Resources Programs, 1800-1960.* Misc. Publ. No. 1233. 1972.

Williams, D. A. — "Progress in 1958." *Soil Conservation*, February 1959.

Williams, D. A. — "Progress in 1957." *Soil Conservation*, January 1958.

Williams, D. A. — "Report of the Administrator Soil Conservation Service 1960." *Soil Conservation*, February 1961.

Williams, D. A. — "The Enhancement of Natural Beauty." *Soil Conservation*, August 1965.

Williams, D. A. — "Rural Renaissance in RC&D Projects." *Soil Conservation,* December 1967.

Williams, D. A. — "World Food and Soil Conservation." *Soil Conservation*, April 1966.

Williams, D. A. — "The New Technical Service Centers." *Soil Conservation*, August 1964.

Williams, D. A. — *Establishment of the SCS Central Technical Unit*. Engineering Memorandum SCS-4. June 8, 1964.

Williams, D. A.	"Reorganization Aims at Fast, Effective Service." *Soil Conservation*, February 1954.
Williams, D. A.	"Soil, Water and Food for Peace." *Soil Conservation,* August 1967.
Williams, D. A.	"What Are We Doing to Our Environment?" *Soil Conservation,* June 1968.
Williams, Hollis	"Agriculture and Water Quality." *Soil Conservation*, May 1969.
Yarnell, D. L.	*Flow of Water through Culverts.* Studies in Engineering, University of Iowa. 1926.

A SAMPLING OF TECHNICAL PAPERS AUTHORED BY INDIVIDUALS WITH A SOIL CONSERVATION SERVICE BACKGROUND

Blaisdell, F. W.	*Hydraulics of Drop-Inlet Pipe-Conduit Spillways.* Report No. MN-R-3-42. Dec 1949.
Blaney, H. F. Criddle, W. D.	*Determining Water Requirements in Irrigated Areas from Climatological and Irrigation Data.* USDA SCS-TP-96. 1950.
Einstein, Hans A.	"Surface-Runoff and Infiltration." *Transactions American Geophysical Union* . Vol. 26, No. III. Dec 1945.
Fortier, Samuel Scoby, F. C.	"Permissible Canal Velocities." Final Report of Special Committee, *Transaction of ASCE*, Vol 89. 1926.
Hamilton, C. L.	*Terracing for Soil and Water Conservation.* USDA Farmers Bulletin 1789 (Rev). 1939.
Musgrave, G. W.	"The Quantitative Evaluation of Factors in Water Erosion, A First Approximation." *Journal of Soil and Water Conservation.* Vol 2, No 3. pg 133-138. July 1947.
Parshall, R. L. Rohwer, Carl	*The Venturi Flume.* Colorado Agricultural Experiment Station Bulletin 265. 1921.
Ramser, C. E.	*Flow of Water in Drainage Channels.* USDA Technical Bulletin 129. Nov 1929.
Ree, W. O.	"Hydraulic Characteristics of Vegetation for Vegetated Waterways." *Agricultural Engineering,* Vol. 30, No. 4. Apr 1949.
Rouse, Hunter	*Engineering Hydraulics.* Proceedings of 4th Hydraulic Conference, Iowa Institute of Hydraulic Research. John Wiley & Sons. 1950. 1039 pg.
Scoby, F. C.	*The Flow of Water in Irrigation Channels.* USDA Agricultural Bulletin 194. 1915.
Sharp, A. L. Holtan, H. N. Musgrave, G. W.	*Infiltration in Relation to Runoff on Small Watersheds.* USDA SCS-TP-81. June 1949.
Sutton, John G.	"Hydraulics of Open Ditches." *Agricultural Engineering,* Vol. 20, No. 5. May 1939.

Yarnell, D. L. *Rainfall Intensity Frequency Data.* USDA Miscellaneous Publication 204. 1935.

ENGINEERS & EROSION SPECIALISTS IN THE SOIL CONSERVATION SERVICE - 1935[1]

Abbot, Henry D. . . . Asst. Chief, Washington, DC
Abbott, Gail T. . . . Erosion Spec.Zanesville, OH
Ackerman, F. G. . . . . Coop. Agt., Hays, KS
Allison, Robt. V. . . . . Acting in Charge, ... Erosion Investigations, Washington, DC
Allison, Ulmont S. . . . Agr. Engineer, Lindale, TX
Anderson, Clyde L. . . . Asst. Erosion Specialist, ... Stafford, AZ
Anderson, E. M., Jr. . . . Jr. Agricultural Eningeer, ... Temple, TX
Anderson, T. C. . . . . . . Jr. Agricultural Engineer . . . . Minden, LA
Andrews, Samuel B. . . . . Asst. Engineer, ... Washington, DC
Angle, Richard W. . . Asst. Agricultural Engineer . . . . Albuquerque, NM
Bailey, Thomas M. . . . . Sr. Eng. Draftsman, ... Spartanburg, SC
Baird, Ralph W. . . . . Assoc. Ag. Engineer . . . . Tyler, TX
Bamesburger, J. G. . . . . Chief Ag. Engineer, ... Santa Paula, CA
Banowsky, Frederick . . . . Jr. Ag. Engineer . . . . Temple, TX
Bartel, Frank O. . . Ag. Engineer, Statesville, NC
Becker, Raymond C. . . . . Jr. Engineer, ... Washington, DC
Bell, Waldo E. . . . Jr. Ag. Engineer, Indiana, PA
Bergschneider, H. E. . . . . Chief, Ag. Engineer, ... Stillwater, OK
Berry, William H. . . . . Principal Eng. Aide, ... Albuquerque, NM
Billingslet, J. P. . . Jr. Ag. Engineer, Danville, VA
Bjorklund, E. C. . Asst. Ag. Engineer, Huron, SD
Bloom, Merle W. . . . . Asst. Ag. Engineer, ... Bethany, MO
Bobst, Harvey G. . . . . Assoc. Ag. Engineer, ... Albion, NE
Bollinger, J. R. . . . Erosion Spec., La Crosse, WI
Boyce, N. E. . . . Jr. Ag. Engineer, La Crosse, WI
Brand, C. H. . . . Asst. Erosion Spec., Athens, GA
Breaux, S. J. . . . . . Jr. Ag. Engineer, Minden, LA
Brenneman, J. A. . . . . . Chief Erosion Specialist, ... Indiana, PA
Brissle, M. B. . . . . Asst. Erosion Specialist . . . . , Rock Hill, SC
Britton, J. C. . . . . . Erosion Spec., Americus, GA
Brown, L. N. . . . . Asst. Ag. Engineer, ... Santa Paula, CA
Brown, W. M. . Jr. Ag. Engineer, High Point, NC
Brown, Hugh A. . . . Erosion Spec., Rock Hill, SC
Bryant, A. E. . . . . . Jr. Erosion Spec., Lindale, TX
Buckaloo, S. C. . Jr. Ag. Engineer, Bethany, MO
Burdette, J. W. . . . . Jr. Erosion Specialist, ... Spartanburg, SC
Burns, J. M. . . . . Jr.Ag. Engineer, Americus, GA
Byars, G. E. . . . . Ag. Engineer, Temple. TX
Calkins, R. S. . . Jr. Ag. Engineer, La Crosse, WI
Carnes, Ernest . . . . Chief Erosion Specialist, ... Spartanburg, SC
Carreker, J. R. . . . . . Ag. Engineer, Dadeville, AL
Casey, J. T. . . . Jr. Ag. Engineer, La Crosse, WI
Cassity, L. H. . . . Asst. Ag. Engr., Champaign, IL
Chambers, T.B. . . . . Acting in Charge, ... Washington, DC
Chapler, J. B. . . . Ag. Engineer, Santa Paula, CA
Chapman, Abel H. . . . . Erosion Specialist, ... Spartanburg, SC
Chapman, C.W. . . Asst. Ag. Engr., Americus, GA
Chapman, D. L. . . Jr. Ag. Engineer, Temple, TX
Chappell, P.B. . . . . Jr. Ag. Engineer, ... Spartanburg, SC
Christy, Donald . . . . Asst. Ag. Engineer, ... High Point, NC
Clark, C. V. . . . . Jr. Ag. Engineer, Athens, GA
Clark, Elmer F. Asst. Ag. Engineer, Bethany, MO
Clark, M. W. . Asst. Erosion Spec., Bethany, MO
Clarke, G. M. . . Chief Ag. Engineer, Danville, VA
Clifford, R. C. . . . . Asst. Ag. Engineer, ... Albuquerque, NM
Coffin, J. W. . . Asst. Erosion Spec., Conway, AR
Cole, Earle A. . . . . Chief Erosion Specialist, ... Mankato, KS
Collier, C. W. . . . Special Asst., Washington, DC
Conners, G. C. . . . . Jr. Hydraulic Engineer, ... Washington, DC
Cook, Howard L. . . . . Hydraulic Engineer, ... Washington, DC
Coyle, James J. . . . . . Ag. Engineer, Lindale, TX
Craig, Hallett E. . . . . Asst. Ag. Engineer, ... Santa Paula, CA
Crittenden, H. H. . . . . Asst. Ag. Engineer, ... Athens, GA
Cummings, Leo B. . . . . Erosion Specialist, ... La Crosse, WI
Cunningham, W. S. . . . Asst. Erosion Specialist, ... Lindale, TX
Davidson, David . . Erosion Spec., La Crosse, WI
Davis, A. M. . . . . Ag. Engineer, Lindale, TX
Davis, E. M. . . . . . Ag. Engineer, Zanesville, OH
Davis, John M. . . . . Asst. Erosion Specialist, ... Spartanburg, SC
Dawson, Oran . . Erosion Specialist, Lindale, TX
Dean, J. M. . . . . Asst. Erosion Specialist . . . . Spartanburg, SC
Deardorff, C. E. . . . . Coop. Agent, Pullman, WA
Deatrick, E. P. . . . . Coop Agent, Statesville, NC
Deeter, E. B. . . . . . Sci. Soil Erosion, Temple, TX
Deppa, J. W. . Erosion Spec., Albuquerque, NM
DeYoung, W. . . . . . Erosion Spec., Bethany, MO
Dominy, W. W. . . . Jr. Ag. Engineer, Temple, TX
Dowdle, H.J. . . . . Asst. Erosion Specialist . . . . Spartanburg, SC
Downing, J. M. . . . . Asst. Ag. Engineer, ... Rock Hill, SC
Drake, R. R. . . . . Assoc. Ag. Engineer, Hays, KS

1 Source: USDA Miscellaneous Publication 233. NOTE: Does not include personnel paid from ECW funds.

Du Puy, W. H. ..... Erosion Spec., Lindale, TX
Dyer, Henry A. ....Asst. Ag. Engineer, ... Spartanburg, SC
Dykes, J. C. .... Erosion Spec., Lindale, TX
Eakin, Henry M. .... Acting in charge, ... Sedimentation Studies, Washington, D.C.
Eargle, D. H. ....Jr. Engineer, Washington, DC
Eden, Edwin W. .... Jr. Ag. Engineer, ... New Brunswick, NJ
Edmiston, F. S. ... Chief Ag. Engr., Minden, LA
Eley, Gail W. Asst. Ag. Engr., New Brunswick, NJ
Engstrom, H. E. .... Chief Ag. Engr., Huron, SD
Espy, Melvin .....Jr. Ag. Engineer, Indiana, PA
Evans, Reid . Asst. Ag. Engineer, Champaign, IL
Everheart, J. D. .... Asst. Erosion Specialist .... Lindale, TX
Fife, Arthur .... Ag. Engineer, Albuquerque, NM
Fleming, B. P. . Chief Ag. Engineer, Stafford, AZ
Fletcher, Guy . Chief Erosion Spec., Minden, LA
Fletcher, L. S. ....Ag. Engineer, Stafford, AZ
Flint, G. M. ..... Erosion Spec., Champaign, IL
Flueck, H. A. ....Chief Erosion Specialist .... La Crosse, WI
Fonken, George W. .... Asst Ag. Engineer, ... La Crosse, WI
Freeburg, Paul J. ....Asst. Ag. Engr., Huron, SD
Freeman, Wm. F. ....Asst. Ag. Engineer, ... High Point, NC
Freitag, Albert . Ag. Engineer, Albuquerque, NM
Freyburger, Edwin .... Assoc. Ag. Engineer, ... Champaign, IL
Fryer, E. R. .... Asst. Erosion Specialist ....Albuquerque, NM
Gatlin, Eugene N. .. Ag. Engineer, Conway, AR
Glymph, L.M., Jr. ....Asst. Ag. Engineer, ... Spartanburg, SC
Goaline, Geo. W. ....Asst. Ag. Engineer, ... Watsonville, CA
Goforth, Allen P. . Jr. Erosion Spec., Lindale, TX
Grace, Ray ....Jr. Ag. Engineer, Dalhart, TX
Granholm, Axel V. .... Jr. Ag. Engineer, ... New Brunswick, NJ
Grant, Atlas O. . Asst. Ag. Engineer, Stafford, AZ
Groves, Andrew W. .. Ag. Engineer, Temple, TX
Gully, Phil ... Asst. Ag. Engineer, Meridian, MS
Haack, Fred W. .Jr. Ag. Engineer, La Crosse, WI
Hair, W. W., Jr. ....Jr. Ag. Engineer, Temple, TX
Hardisty, F. E. ...... Ag. Engineer, Athens, GA
Harper, Dale E. .... Jr. Ag. Engineer, ... Colorado Springs, CO
Hartman, M. A. ...Jr. Ag. Engineer, Temple, TX
Hays, Orville E. ... Coop. Agent, La Crosse, WI
Hbel, W. T. .. Jr. Erosion Specialist, Indiana, PA
Hendrickson, B. H. ..Sci. Soil Erosion, Tyler, TX
Hickok, R. B. .... Asst. Ag. Engineer, ... Zanesville, OH
Higgins, F. L. .... Erosion Spec., La Crosse, WI
Hill, F. W. ....Asst. Ag. Engineer, ... Colorado Springs, CO
Hill, Henry O. .. Chief Ag. Engineer, Temple, TX
Hill, S. N .M. .... Asst. Erosion Specialist, ... La Crosse, WI
Hobbs, H. W. .... Ag. Engineer, Bath, NY
Hodgin, B. R. .... Chief Ag. Engineer, ...Albuquerque, NM
Hoff, Paul R. ...... Ag. Engineer, Mankato, KS
Holcombe, H. B. .... Erosion Specialist, ... New Brunswick, NJ
Holman, Adam T. ..Ag. Engineer, Bethany, MO
Hood, George W. ....Ag. Engineer, Albion, NE
Hopkins, Paul L. .Jr. Civil Engineer, Temple, TX
Hopper, Hugh L. ......Chief Erosion Specialist .... Meridian, MS
Horning, T. R. .. Jr. Ag. Engineer, Pullman, WA
Howell, G. P.T. . Ag. Engineer, Albuquerque, NM
Hudson, John H. ..Jr. Ag. Engineer, Athens, GA
Huggler, C. M. .... Sr. Eng. Draftsman, ... Conway, AR
Hungerford, D. S. ...Erosion Spec., Athens, GA
Hunter, G. B. .. Asst. Erosion Spec., Indiana, PA
Hurd, H. W. ... Ag. Engineer, Albuquerque, NM
Hutton, J. G. .. Chief Erosion Spec., Huron, SD
Jackson, H. C. ... Erosion Spec., La Crosse, WI
Jacobson, Paul .. Asst. Ag. Engr., Bethany, MO
Janzen, Frank O. .... Jr. Erosion Specialist, ... La Crosse, WI
Jensen, Elof B. .... Ag. Engineer, ...Albuquerque, NM
Jepson, Hans G. . Asst. Ag. Engr., Spenser, WV
Jernigan, E. C. .... Asst. Erosion Specialist .... Greensboro, NC
Jobs, Robin N. .. Asst. Ag. Engineer, Albion, NE
Johnson, A. J. .... Erosion Spec., Pullman, WA
Johnson, C. C. ... Chief Ag. Engr., Pullman, WA
Johnson, Earl G. .... Chief Ag. Engineer, ... Zanesville, OH
Johnson, Ernest C. . Erosion Spec., Lindale, TX
Johnson, Ruben C. .... Ag. Engineer, ... Spartanburg, SC
Jones, Clinton M. .... Jr. Ag. Engineer, ... Danville, VA
Jones, Harry E. ... Ag. Engr., Albuquerque, NM
Jourdan, John W. .... Sr. Ag. Engineer, ...Albuquerque, NM
Judah, Courtney T. .... Jr. Ag. Engineer, ... Watsonville, CA
Kaetz, A, George ....Ag. Engineer, Stafford, AZ
Keliher, Martin M. ....Jr. Erosion Specialist .... La Crosse, WI
Kennard, Thomas C. .... Erosion Specialist .... Zanesville, OH
Kesler, Thomas L. ...Jr. Engr., Washington, DC
Kidman, Bert ...Asst. Erosion Spec., Huron, SD
Kiff, Glenn P. .Asst. Ag. Engr., Albuquerque, NM
Kimball, Frank ....Ag. Engineer .... Colorado Springs, CO
Kincannon, W. G. .... Erosion Specialist .... High Point, NC
Kinnear, Edwin R. .... Chief Ag. Engineer, ... Colorado Springs, CO
Knapp, Frank H. .. Chief Ag. Engr., Stafford, AZ
Knight, R. E. .... Jr. Ag. Engineer, Bethany, MO
Kramer, E. W. .... Asst. Erosion Specialist, ... Stafford, AZ
Krimgold, D. B. ....Asst. Ag. Engineer, ... Washington, DC
Lacy,Howell E. ...... Ag. Engineer, Athens, GA
Landrine, B. X. ....Jr. Ag. Engr., Zanesville, OH
Latham, J. Fred .. Asst. Ag. Engr., Stillwater, OK
Lawrence, G. A. ....Asst. Ag. Engineer, ...Albuquerque, NM
LeMert, H. W. ......Ag. Engineer, Bethany, MO
Libby, A. C. ..... Erosion Spec., La Crosse, WI
Little, J. M. .. Ag. Engineer, New Brunswick, NJ
Logan, C. A. .... Ag. Engineer, Mankato, KS
Lowry, Carl J. ... Jr. Ag. Engineer, Bethany, MO

Lowry, Wayne H. . . . . . . Asst. Erosion Specialist . . . . Champaign, IL
Luckey, D.F. Jr. . Jr. Ag. Engineer, Paducah, KY
Luna, Raymond C. . . Sr. Draftsman, Athens, GA
Luxa, Anton, L. . . . Asst. Ag. Engr., Stillwater, OK
Maddock, Thomas . . . . Asst. Ag. Engineer, ... Stafford, AZ
Mahel, John R. . . . . . Ag. Engineer, Bethany, MO
Mallery, K. B. . . . . Jr. Erosion Spec., Indiana, PA
Marshall, B. L. . . . . Asst. Erosion Specialist, ... New Brunswick, NJ
Martin, C. C. . . . . . . Agr. Engineer, Mankato, KS
Mason, Howard . . . . . . Chief Erosion Specialist . . . . New Brunswick, NJ
Mason, W.A., Jr. . . . . Asst. Erosion Specialist . . . . Spartanburg, SC
Matson, Howard . . . . Ag. Engineer, Lindale, TX
McAlister, E. E. . . . . Asst. Erosion Specialist, ... Lindale, TX
McAlister, J. T. . . . . Chief Ag. Engineer, ... Spartanburg, SC
McCain, John I. . . Jr. Ag. Engineer, Minden, LA
McCall, H. L. . . . Asst. Ag. Engineer, Minden. LA
McCarthy, T. H. . . . . Assoc. Ag. Engineer, ... Albuquerque, NM
McCash, C. J. . . . . Asst. Ag. Engineer, ... Albuquerque, NM
McGowan, T. F. . . . . Jr. Ag. Engineer, ... Watsonville, CA
McGrath,R.L. . Asst. Ag. Engr., Washington, DC
McGrew, Paul C. . . . Ag. Engineer, Pullman, WA
McLean, John E. . Research Asst., Dadeville, AL
McNitt, W. J. . . . . . Jr. Erosion Spec., Indiana, PA
McWhorter, G. E. . . . . . Chief Erosion Specialist . . . . Dadeville, AL
Meares, George A. . . . . Asst. Ag. Engineer, ... Spartanburg, SC
Mech, Stephen J. . . . . . Jr. Ag. Engr., Lindale, TX
Merkel, George C. . . Jr. Ag. Engr., Bethany, MO
Middleton, H. E. . Assoc. Phys., Washington, DC
Morris, G.M. . . . . Erosion Spec., Lindale, TX
Mortimore, M.E.,Jr. . . . . . Jr. Erosion Specialist, ... Bethany, MO
Muncey, James A. . . . . Asst. Ag. Engineer, ... High Point, NC
Musgrave, G. W. . Sci. Soil Erosion, Clarinda, IA
Musser, Ralph H. . . . . Erosion Specialist, ... Colorado Springs, CO
Neal, Oren R. . . Jr. Erosion Spec., Bethany, MO
Nelson, L. E. . . . Jr. Ag. Engineer, La Crosse, WI
Norton, R. A. . . Assoc. Ag. Engineer, Clarinda, IA
Nunn, Wesley G. . . Asst. Ag. Engr., Danville, VA
Oberlin, R. W. . . . . Chief Ag. Engr., Bethany, MO
Ogrosky, H. O. . . . . Jr. Ag. Engr., La Crosse, WI
Olson, Lois . Asst. in Research, Washington, DC
Osterberger, A.V. . Jr. Ag. Engineer, Minden, LA
Owens, Ivan C. . . . . Erosion Spec., Spencer, WV
Palmer, N. L. . . . . Asst. Ag. Engr., Meridian, MS
Palmer, V. J. . . . . . Asst. Ag. Engr., La Crosse, WI
Parsons, D. A. . . . . Asst. Hydr. Engineer, ... Washington, DC
Pearson, R. F. . . . Jr. Ag. Engineer, Temple, TX
Peck, James A. . . . . Ag. Engineer, ... Colorado Springs, CO
Phillips, E. L. . . . . Jr. Ag. Engineer, Indiana, PA
Pope, Richard R. . . . . Chief Ag. Engineer, ... New Brunswick, NJ
Porterfield, H. G. . Jr. Erosion Spec., Dalhart, TX
Potter, Ray M. . . . . Asst. Ag. Engr., Stafford, AZ
Pridgeon, T.O. . . . . Asst. Erosion Specialist, ... Lindale, TX
Quate, Graham S. . . . . Asst. Ag. Engineer, ... Albuquerque, NM
Quertermous, R.M. . . . . Asst. Ag. Engineer, ... Conway, AR
Ramser, C. E. . . . . Acting in Charge, ... Watershed Studies, Washington, DC
Rau, William M. . . . . . Ag. Engineer, Stafford, AZ
Reese, Carroll A. . . Jr. Ag. Engr., La Crosse, WI
Reese, Robert J. . . . . Jr. Ag. Engineer, ... State College, PA
Reid, Earl C. . . . . . Jr. Ag. Engineer, Conway, AR
Reynolds, F. S. . . . . . . Ag. Engineer, Dalhart, TX
Rich, Lowell R. . . . . Asst. Ag. Engineer, ... Albuquerque, NM
Richards, R. S. . Sr. Draftsman, Santa Paula, CA
Ricker, Conny C. . Asst. Ag. Engr., Paducah, KY
Riddell, Glen E. . . . . Chief Erosion Spec., ... Conway, AR
Riesbol, H. S. . . . . Assoc. Ag. Engr., Guthrie, OK
Roberts, W. M. . . . . Jr. Erosion Spec, ... La Crosse, WI
Robinson, Frank . . . . Jr. Ag. Engineer, ... Albuquerque, NM
Roth, Arthur T. . . . Jr. Ag. Engineer, Indiana, PA
Russell, David A. . . . . Asst. Ag. Engineer, ... Champaign, IL
Ryan, Dennis M. . . . Jr. Ag. Engr., La Crosse, WI
Ryerson, Gerald E. . . Ag. Engineer, La Crosse, IL
Sally, J.F. . . . . Jr. Ag. Engineer, Bath, NY
Sauser, Cyril J. . . . . Assoc. Ag. Engineer, ... Albuquerque, NM
Scheiin, R. G. . . Jr. Erosion Spec., La Crosse, WI
Schiff, Leonard . Jr. Ag. Engr., Santa Paula, CA
Schlaudt, Edo A. . . . . Asst. Ag. Engineer, ... High Point, NC
Schoenlabor, L. H. . . . . Asst. Ag. Engineer, ... Bethany, MO
Seavy, Louis M. . . Jr. Engineer, Washington, DC
Shockley, Dale R. . . . . Asst. Ag. Engineer, ... Albuquerque, NM
Small, Warner B. Asst. Ag. Engineer, Albion, NE
Smith, Dwight D. . Asst. Ag. Engr., Bethany, MO
Smith, Henry N. . . . . Erosion Spec., Lindale, TX
Smith, Sam, Jr. . . . . Jr. Ag. Engineer, ... New Brunswick, NJ
Solomon, Lester . . . . . Asst. Erosion Specialist, ... Paducah, KY
Spencer, C. B. Chief Erosion Spec., Lindale, TX
Springer, Dale E. . Asst. Ag. Engr., Bethany, MO
Stager, Walter E. . . . . Jr. Erosion Specialist, ... New Brunswick, NJ
Staley, John N. . . . . . . Asst. Erosion Specialist, ... La Crosse, WI
Stambaugh, V. W. . . . . Assoc. Ag. Engineer, ... Colorado Springs, CO
Steen, Enoch R. . . Jr. Erosion Spec., Dalhart, Tx
Stephenson, N. P. . . Erosion Spec., Lindale, TX
Stevenot, Edward W. . . . . Jr. Ag. Engineer, ... Santa Paula, CA
Stoker, John R. . . . . Asst. Ag. Engineer, ... Colorado Springs, CO
Stokes, Charles M. . . . . Chief Erosion Specialist, ... Stafford, AZ
Stott, Hester M. . . . . . . Asst. Erosion Specialist, ... High Point, NC

Struble, Vern T. .... Erosion Spec., Indiana, PA
Sturgeon, Ralph A. . Ag. Engineer, Conway, AR
Tagge, Herman F. Erosion Spec., La Crosse, WI
Tardy, Fred E. ...Jr. Engineer, Washington, DC
Taylor, Benjamin L. .Ag. Engineer, Meridian, MS
Taylor, Delbert H. .... Asst. Erosion Specialist, ...Lindale, TX
Teare, D. W. . Asst. Ag. Engineer, Champaign, IL
Tetrud, William H. . .Jr. Ag. Engr., La Crosse, WI
Teute, William E. . .Asst. Ag. Engineer, Bath, NY
Thalmann, V.W. ... Asst. Ag. Engr., Conway, AR
Thigpin, Robert L. .Jr. Ag. Engineer, Temple, TX
Thomas, Calvin D. . .Jr. Ag. Engr., La Crosse, WI
Thomas, Horace L. ... Asst. Erosion Specialist, ...La Crosse, WI
Thompson, Fred A. .... Jr. Ag. Engineer, ... Spartanburg, SC
Thornthwaite, C.W. ....Acting in Charge, ...Climatic Investigations, Washington, DC
Tillotson, R. J. .. Jr. Ag. Engineer, Bethany, MO
Tribou, Henry R. . .Jr. Ag. Engr., High Point, NC
Tschudy, Lionel C. ... Ag. Engineer, Huron, SD
Utz, Ervin J. . Acting in Charge, Erosion Control, ... Washington, DC
Vail, Theodore P. ....Asst. Ag. Engineer, ... New Brunswick, NJ
Van Doren, Loyal, Jr. .... Jr. Ag. Engineer, ...La Crosse, WI
Varnell, Earle H. .... Erosion Spec., Lindale, TX
Voelker, Eugene I. .... Jr. Ag. Engineer, ... New Brunswick, NJ
Voelker, Eugene I. .... Jr. Ag. Engineer, ... New Brunswick, NJ
Wackerbarth, H. F. ....Asst. Ag. Engineer, ... Stafford, AZ
Walker, Walter H. ..... Chief Erosion Specialist, ... Muskogee, OK
Wallace, Harry M. .... Chief Ag. Engineer, ...Muskogee, OK
Walter, Davis H. ...... Asst. Erosion Specialist, ...Indiana, PA
Wanser, Henry M. .... Chief Erosion Specialist, ...Pullman, WA
Warner, William C. ... Asst. Erosion Specialist, ...Greensboro, NC
Waters, Louis W. ....Asst. Ag. Engineer, ...Santa Paula, CA
Watson, Alvin C. ...Asst. Ag. Engr., Indiana, PA
Welch, C. H., Jr. ...... Asst. Erosion Specialist, ...La Crosse, WI
Weld, William A. ....Asst. Ag. Engineer, ...Greensboro, NC
Weston, Earl P. ...... Chief Erosion Specialist, ... Stillwater, OK
White, Robert G. ... Jr. Ag. Engr., Bethany, MO
Whitmus, Harold V. .. Sr. Draftsman, Huron, SD
Wickes, Dean R. ...... Acting Chief,Research, ...Washington, DC
Wiggins, James E. .. Jr. Ag. Engr., Danville, VA
Wight, George D. ..... Asst. Erosion Specialist, ...La Crosse, WI
Wilder, Carlos B. ...Jr. Ag. Engr., Americus, GA
Wilson, Norman W. .Ag. Engineer, Dadeville, AL
Witherell, Robert E. . .Ag. Engineer, Stafford, AZ
Wolfe, Emerson . Jr. Ag. Engineer, Bethany, MO
Wolfe, Peter E. .... Jr. Erosion Specialist, ...New Brunswick, NJ
Womble, William R. .Asst. Ag. Engr., Minden, LA
Wood, James B. ..... Asst. Erosion Specialist, ...Spartanburg, Sc
Woodburn, Russell ...... Assoc. Ag. Engineer, ...Paducah, KY
Woodruff, C. M. ... Coop. Agent (Erosion Asst.), ... Bethany, MO
Woodyard, Donald H. ...... Senior Draftsman, ... Stillwater, OK
Worthington, J.P. ....Asst. Ag. Engineer, ...Albuquerque, NM
Wrenn, Frank G. Asst. in Research, Dadeville, AL
Wright, C.W. .Asst. Ag. Engr., Albuquerque, NM
Wright, Irvin D. .... Jr. Ag. Engineer, Albion, NE
Yeo, Herbert W. ....Asst. Ag. Engineer, ...Albuquerque, NM
Yesland, Alfred . Jr. Ag. Engineer, Pullman, WA
Young, Vilas D. . Asst. Ag. Engr., Zanesville, OH
Zwerner, Gene A. .Jr. Engineer, Washington, DC

Note: Some of the Erosion Specialists were not engineers by training but their duties required an understanding of engineering techniques as well as expertise in agronomy and soil science.

ENGINEERS AND RELATED PROFESSIONALS IN TECHNICAL LEADERSHIP POSITIONS SOIL CONSERVATION SERVICE

WASHINGTON HEADQUARTERS

Engineering Division

Director .... B.P. Fleming
.... James G. Lindley
.... Thomas. B. Chambers
.... Karl O.Kohler, Jr.
.... George D. Clyde
.... Chester J. Francis
.... John T. Phelan
.... Neil F. Bogner
.... Buell M. Ferguson
.... Donald L. Basinger
.... *Gerald D. Seinwill

Deputy Director .... *Wendell B. Moody

Asst. Director .... Samuel B. Andrews
.... William X. Hull
.... John G. Bamesburger
.... John T. Phelan
.... Harold C. Enderlin
.... Neil F. Bogner
.... R.C. Barnes
.... Robert M. Pasley
.... Donald L. Basinger
.... Wendell B. Moody

Agricultural Engineering .... T.B. Chambers
.... R.L. McGrath
.... C.L. Hamilton
.... Arnold Davis
.... James J. Coyle
.... R.C. Barnes, Jr.
.... Richard E. Highfill
.... *Lee P. Herndon

Civil Engineering .... Raymond H. Davis
(Work Plans) .... Alfred M. Hedge
.... Richard E. Reinke
.... William G. Shannon
.... Clarence E. Ghormley
.... Arthur B. Holland
.... Richard E. Highfill
.... Edgar H. Nelson
.... Joseph S. Haugh

Construction .... John S. Grant
.... W.A. Holweg
.... H.R. McCall
.... Hans G. Jepson
.... Chester J. Francis
.... John G. Bamesberger
.... Melvin M. Culp
.... Paul E. Nylander
.... *Mervin R. Ice

Design .... Wallace Ashby
.... Chester J. Francis
.... John G. Bamesberger
.... Melvin M. Culp
.... Alan S. Payne
.... David C. Ralston
.... *James R. Talbot
.... *John A. Bevard

Drainage .... Lewis A. Jones
.... Roger D. Marsden
.... John G. Sutton
.... Louis W. Herndon
.... Walter J. Ochs
.... Richard O. Wenberg

Engineering Geology .... Victor H. Jones
.... Earl F. Dosch
.... Alfonso F. Geiger
.... Peter V. Patterson
.... Louis Kirkaldie
.... James B. Hyland

Environment, Water Quality & .... J.B. Thomas
Waste Management .... Louis Brandt
.... Charles E. Fogg
.... *James N. Krider

Erosion Control Specialists ..... Lewis A. Jones
.... Glenn L. Fuller
.... G.W. Musgrave
.... Alva D. Brandt
.... Forrest G. Bell
.... Gilbert B. Posey

Climatic Investigations C. Warren Thornthwaite
& Erosion Ecology .... Lois Olson
.... David I. Blumenstock
.... Benjamin Holtzman
.... Otto E. Guthe
.... Arthur C. Ringland

Hydraulics
.... Harold L. Cook
.... Melvin M. Culp
.... Harold O. Ogrosky
.... Harvey H. Richardson

* Incumbent - Occasionally, some individuals have had dual technical or dual area responsibilities. Titles have frequently changed but the responsibility or technical field as presently understood is indicated. Names have been compiled from scattered lists, reports, and the memories of a number of SCS veterans. It is likely that some have been missed.

Hydrology .... William C. Ackerman
.... C. E. Ramser
.... Dav B. Krimgold
.... H. T. Cory
.... T. B. Chambers
.... George W. Mmxgrave
.... Harold O. Ogrosky
.... Kenneth M. Kent
.... Robert E. Rallison
.... *Norman Miller
.... *Helen F. Moody
.... *Donald E. Woodward

Irrigation .... W. W. McLan
.... John G. Sutton
.... Frank Kimball
.... George D. Clyde
.... Tyler H. Quackenbush
.... Ralph H. Brownscombe
.... Carl L. Anderson
.... Swayne F. Scott
.... Richard W. Van Klaveren

Landscape Architecture .... J. J. Columbus
.... Sally Schauman
.... *Ronald W. Tuttle

Mechanical Engineering .... Everett Wilcox
.... S. B. Andrews

Mechanical Equipment .... R. B. Gray
.... Gerald E. Ryerson
.... E. J. Thomas

Geology and Ground Water .. *Jerry M. Bernard

Sedimentation Geology .... Henry M. Eakin
.... Gilbert C. Dobson
.... Carl B. Brown
.... Louis C. Gottschalk
.... John W. Roehl
.... John N. Holeman
.... William F. Mildner
.... C. Donald Clarke

Information Systems .... *Jackie D. Diggs

Soils Engineering .... Rey Decker
.... David C. Ralston
.... *James R. Talbot

Water Management ...... *William J. Carmack
.... *Ronald L. Marlow

Water Quality .... *Wildon Fontenot
.... *Frederick D. Theurer
.... *George H. Comer

Water Supply .... George D. Clyde (Logan)
Forecasting .... William C. Shannon
.... Arthur B.Holland
.... Robert E. Rallison
.... R.A. Work (Portland)
.... Manes Barton (Portland)
.... *D.E. Johnson (Portland)

<u>Ecological Science Division</u>
Wetland Hydrology ..... *Donald E. Woodward

<u>Cartography and Geographic Information Systems Divison</u>
Hydraulics .... *Roger Cronshey

<u>Technology Information Systems Divison</u>
Technology Support Team ..... *Gylan Dickey
.... *Russ Shepherd
.... *Frank Geter
.... *Kenneth Brashear
.... *Carol Drungil

Decision Support Model
Development Team .... *Ed Seely

Practice Design
Development Team .... *Harvey Metz
.... *Ken Carpenter
.... *Philip Smith

System Building and
Support Team .... *Scott Snover
.... *Dennis Miyoshi

SCS ENGINEERS AND GEOLOGISTS IN RESEARCH

R. V. Allison ....Washington, DC
V. S. Aronovici ....Pomona, CA
Willis Barrett .... Logan, UT
Fred W. Blaisdell ....St. Paul, MN
Harry F. Blaney ....Los Angeles, CA
George B. Bradshaw ....Boise, ID
Carl B. Brown ....Washington, DC
John R. Carreker ....Athens, GA
George D. Clyde .... Logan, UT
Ashton Cod ....Bozeman, MT
William . Cone ....Fort Collins, CO
Howard L. Cook ....Washington, DC
Earl W. Cowley
Wayne D. Criddle .... Logan, UT
Sterling Davis ....Boise, ID
G. C. Dobson ....Washington, DC
William W. Donnan ....Los Angeles, CA
Maurice Donnelley .... Riverside, CA
Henry M. Eakin ....Washington, DC
Talcott W. Edminister .... Blacksburg, VA
Hans A. Einstein .... Pasadena, CA
Leonard J. Erie .... Brookings, SD
Ross Eskelson .... Logan, UT
Claude L. Fly
Jack Frost .... Medford, OR
Dean Fuhriman .... Logan, UT
W. V. Garstka .... Salt Lake City, UT
Louis M. Glymph .... Spartanburg, SC
Fred Hamilton ....Lincoln, NE
Lloyd L. Harold .... OH
Karl Harris .... Phoenix, AZ
Robert B. Hickok ....Lafayette, IN
Clyde E. Houston .... Reno, NV
O. W. Israelson .... Logan, UT
C. B. Jarvis
Lewis A. Jones ....Washington, DC
Dov B. Krimgold ....Washington, DC
Cyril W. Lauritzen .... Logan, UT
H. R. Leach
W. C. Lowdermilk ....Washington, DC
James Marr ....Boise, ID
Walter W. McLaughlin .... Berkeley, CA
Steven J. Mech .... Pendleton, OR
Walter R. Meyer ....Garden City, KS
Howard E. Middleton ....Washington, DC
G.W. Musgrave ....Washington, DC
Lloyd E. Myers .... Reno, NV
H. E. Middleton ....Washington, DC
Don Mitchell .... Logan, UT
A. T. Mitchelson .... Berkeley, CA
Dean C. Muckel .... Berkeley, CA
G. W. Musgrave ....Washington, DC
Earl Neff ....Sidney, MT
Mark L. Nichols ....Washington, DC
Lois Olson ....Washington, DC
Claude H. Pair ....Boise, ID
Ralph L. Parshall ....Fort Collins, CO
Donald A. Parsons ....Washington, DC
Greg Pearson .... Logan, UT
H. Burke Peterson .... Phoenix, AZ
Charles E. Ramser ....Washington, DC
William O. Ree ....Stillwater, OK
August R. Robinson ....Fort Collins, CO
Carl H. Rohwer ....Fort Collins, CO
Hayden Rouse .... Gunnison, CO
Hunter Rouse .... Pasadena, CA
Gerald E. Ryerson ....Washington, DC
Leonard Schiff .... Bakersfield, CA
Fred Scobey .... Berkeley, CA
Dwight L. Smith .... Bethany, MO
Janes H. Stallings ....Washington, DC
Homer J. Stockwell .... Twin Falls, ID
Norris P. Swanson ....Lincoln, NE
G. W. Thornthwaite ....Washington, DC
Fred M. Tileston ....Pendleton, OR
Russell E. Uhland ....Washington, DC
Vito Vanoni .... Pasadena, CA
J. L. Weber
Ivan D. Wood .... Denver, CO
Neil P. Woodruff ....Manhattan, KS
Austin Zingg

SPECIALIZED ENGINEERING UNITS

Engineering Standards Unit
Head .... Melvin M. Culp
.... Woody L. Cowan
Engineer .... Carroll A. Reese
.... Paul D. Doubt

Design Section (Unit)
Head .... Paul D. Doubt
.... Edwin S. Alling
.... Scott D. Snover
Design Engineer .... Richard Matthews
.... Rulon Jensen
.... Charles E. Fogg
.... Hun Jin Goon
.... Arthur R. Gregory
.... Gerald E. Oman
.... Norman P. Hill
.... Elwood Lanier
.... John A. Brevard
.... Fred Theurer
.... James Haglund
.... George Kalkanis

Soil Mechanics Laboratory (Lincoln, NE)
Head .... Rey S. Decker
.... Lorn P. Dunnigan

Central Technical Unit (Hydrology Unit)
Head .... Woody L. Cowan
.... Roy G. Andrews
.... Kenneth M. Kent
.... Robert E.Maclay
.... Robert M. Pasley
.... Norman Miller
.... Donald E. Woodward

Hydrologist .... Victor Mockus
.... H. N. Holtan
.... J. H. Dawes, Jr.
.... Melvin H. Kleen
.... William H. Sammons
.... Wendell A. Styner
.... Robert M. Pasley
.... Edward Richer
.... Marc Boysen
.... Erland B. Warnick
.... Harvey Richardson
.... Roger G. Cranshey
Geologist .... Victor H. Jones
.... Alfonso F. Geiger
.... John N. Holeman
.... James R. Thompson
.... Donald H. Hixson
.... Frederick K. Heller
.... William F. Mildner
.... Robert Boyce

National Engineering Staff
Staff Leader .... Robert M. Pasley
.... Douglas E. Hawkins

Head Design .... Edwin S. Alling
.... Scott D. Snover
Civil Engineer .... George Kalkanis
.... John A. Brevard
.... Hun J. Goon
.... Fred Theurer
.... James Haglund
Agr. Engineer .... Oscar Perez
.... Richard L. Phillips
.... Homer C. Moore
.... Walter K. Twitty
Head Hydro. .... Norman A. Miller
.... Donald Woodward
Hydrologist .... Harvey Richardson
.... George Comer
.... Roger G. Cronshey
.... Mark Boysen
.... William Merkel
.... Helen Moody

Geologists:
Groundwater .... Robert C. Boyce
Sedimentation .... Wm. F. Mildner
Landscape Architect .... Gary Wells

Technology Development
Head .... Douglas E. Hawkins

Software Maintenance
Head .... Scott D. Snover
Computer Analyst .... Jacqueleyne D. Diggs
.... Ron Marlow
.... David Butler

Technology Development Staff
Head .... Donald E. Woodward
Hydrology Engineer .... H. H. Richardson
.... Roger G. Cronshey
.... William H. Merkel
.... Cory Wright
.... Helen Moody
.... David Ferguson
.... Fred Theurer
.... George Comer
Civil Engineer .... John A. Brevard
.... Hun J. Goon
Agricultural Engineer .... Oscar Perez

Technology Development
Leader .... Fred Theurer
.... George Comer
Computer Supervisor .... Margaret K. Wolf
Analyst .... Jacqueleyne D. Diggs
.... David Ferguson
.... Cory Wright

REGIONAL OR MULTISTATE HEADQUARTERS

Lincoln, Nebraska

Regional Engineer or Head .... C. J. Francis
.... Dwight S. McVicker
.... Kenneth M. Kent
.... Elwin D. Butler
.... Buell M. Ferguson
.... Eugene J. Pope
.... Wendell Moody
.... Robert Gray
.... *Michael Schendel

Agricultural Engineering .... H. G. Bobst
.... Grant Woodward
.... Richard J. Patronsky
.... Roger C. Moe
.... Owen J. Kuittem

Construction .... Edward E. Stipsky
.... Eugene J. Pope
.... Wendell B. Moody
.... *Joseph F. Calder

Design .... W.R. Edgington
.... C.A. Reese
.... E.S. Alling
.... Axel C. Boilesen
.... Richard Barnett
.... *Dennis L. Hurtz
Drainage .... Earl W. Cowley
.... Tyler H. Quackenbush
.... John T. Phelan
.... William F. Long
.... Guy B. Fasken
.... Richard J. Patronsky
.... John F. Rice
.... *Thomas A. Keep

Environment, Water Quality
& Waste Disposal .... Richard J. Patronsky
.... Ray Cope
.... Malvern Allen
.... *William H. Boyd

Engineering Geology .... Oliver J. Scherer
.... Donald H. Hickson
.... Richard L. Bateman
.... *James L. Kearney

Grouting .... Ray Cope

Hydrology .... Kenneth M. Kent
.... William J. Owen
.... *Robert O. Kluth

Hydrologist .... *Roel C. Vining
Irrigation .... H.G. Bobst
.... Earl W. Cowley
.... Tyler H. Quackenbush
.... John T. Phelan
.... Glenn E Stucky
.... Grant Woodward
.... Keith H. Beauchamp
.... Eugene J. Pope
.... Paul E. Lucas
.... Robert L. Gray
.... Gylan L. Dickey
.... *Leland A. Hardy

Landscape Architecture .... *Gary Wells

Equipment Supervisor ..... Dwight S. McVicker

Planning .... I. T. Hermanson
.... Richard Barnett
.... Paul O. Nielsen
.... J. P. Cavanaugh
.... *Robert M. Bartels

Recreation .... Charles V. Bohart
River Basins .... P. V. Nielsen

Sedimentation Geology ...... Victor O. Kohler
.... W. J. Abrams
.... Eldon M. Thorp
.... Charles D. Clarke
.... Jerry M. Bernard
.... *Lyle Steffin

Soils Engineering .... Clarence E. Dennis
.... Greg Cunningham

Soil Mechanics Laboratory . Lorn P. Dumnigem
.... *Phillip M. Jones

Zone Engineers .... Clarence D. Brehm
.... Dayton R. Vallicott
.... Eugene H. Sperry
.... Steven J. Kortan
.... Victor B. Fredenhagen

Albuquerque, New Mexico

Regional Engineer or Head ...... B. P. Fleming
.... F. D. Matthews
.... John G. Bamesberger
.... Dale Shockley (Acting)

Agr. Engineering

Construction

Design

Drainage .... Rey S. Decker

Eng. Geology .... Parry Reicher
.... Daniel H. Griswold
Hydrology .... J. H. Dorrah, Jr.

Irrigation .... Dale Shockley
.... Ralph Brownscombe

Soil Mechanics ....Rey S. Decker

Watershed Geology .... Eldon M. Thorp

Watershed Planning ..... Harold M. Elmendorf

Zone Engineers .... Orville Hosmer
.... Merrit Penwell
.... William Bennett
.... Stewart Robeson
.... Charles Stokes
.... Dale Shockley

Unit discontinued 1956

Williamsport, Upper Darby, Broomall, & Chester, Pennsylvania

Regional Engineer or Head .... C. A. Frye
.... Walter S. Atkinson
.... Fred Larson
.... Harold M. Kautz
.... Neil F. Bogner
.... Arthur B. Holland
.... Edward L. Helmey
.... James N. Krider
.... *Lloyd E. Thomas

Agricultural Engineering ...... Glenn E. Stucky
.......................Donald McCandless
.... William Annable
.... *Fred Schuetz
....

Construction .... Glenn W. Grubb
.... Neil F. Bogner
.... H. P. Parker
.... Edward L. Helmey
.... Lloyd Thomas
.... John Robb
.... *Wendell Scheib

Design .... R. S. Calkins
.... Gerald E. Oman
.... Lloyd Thomas
.... *James Stingel

Drainage .... Elmer W. Gain
.... Donald E. McCandless
.... Richard D. Wenberg
.... *Rodney White

Engineering Geology .... R. F. Fonner
.... T. J. Ackard
.... Louis Kirkaldie
.... *John Moore

Environment Water Quality
& Waste Management .... Glenn E. Stucky
.... James N. Krider
.... James J. Burke
.... Malvern Allen
.... Frank Geter

Hydrology .... V. McKeever
.... Norman Miller
.... D. E. Woodward
.... *Paul I. Wella

Irrigation .... Gail W. Eley
.... Glen E. Stucky
.... J. N. Krider
.... Gaylan L. Dickey
.... *Leland A. Hardy

Landscape Architecture ..... Ronald W. Tuttle
.... Betty B. Sanders
.... *Robert Escheman

Planning .... John H. Wetzel
.... C. E. Smith
.... T. J. Lewis
.... Karl F. Otte, Jr.
.... James Stingel
.... *Salvador Palalay

Recreation .... W. H. Appel
.... H. G. Uhlig

Sedimentation Geology .... J. L. Hunt
.... *Thomas A. Iivari

Soil Engineering .... R. E. Nelson
.... H. W. Hall
.... *William Hughey

Water Quality Specialist .... *Carl DuPoldt

National CADD Specialist ...... Ken Carpenter

Zone Engineers .... Robert Caulkins
.... Gail W. Eley
.... William R. Moore
.... S. J. Smith, Jr.
.... K. S. Werkman
.... K. P. Wilson

Spartanburg, South Carolina

Regional Engineer or Head ...... Arvy Carnes
.... Thomas B. Chambers

Agricultural Engineering .... E. M. Davis

Construction .... E. N. Everett

Design .... Carroll A. Reese

Drainage .... H. G. Edwards
.... E. A. Schlaudt

Engineering Geology .... F. K. Heller

Hydrology .... N. E. Leach

Irrigation .... George M. Renfro, Jr.

Planning .... Harry G. Edwards
.... Eugene C. Buie

Sedimentation Geology ....J. W. Roehl
Zone Engineers .... John M. Burns
..............................L. D.Worley
.... H. H. Lester

............................F. E. Hardisty
.... George Sparrow
.... J. T. McAllister
...........................Frank Bartell
.... John Downing
.............................R. L. Lester
.... Wallace Smith

Unit discontinued 1964

Portland, Oregon

Regional Engineer or Head ......Karl O. Kohler
.....................John G. Bamesburger
.......................Francis K. Muceus
...............................Ellis Hatt
.............................E. J. Core
..........................Paul O. Tilker
.... Stan Hobson
........................Jack Stevenson
.........................Williams Evans
.... *R. W. Van Klaveren

Agricultural Engineering ...... Wendell Styner
..........................Gordon Stroup
............................Larry Dawson
.... *Gary E. Formanek

Construction ....W. R. Stanley
........................Jack C. Stevenson
.....................*Robert Middlecamp

Design .... F. K. Muceus
.... D. C. Ralston
.... Richard M. Mathews
.... *Donald E. Wallin

Drainage ....George B. Bradshaw
.....................H. R. Brownscombe
.... William F. Long
.... G. W. Stroup
.... Elwin Ross
.......................*Virgil L. Backlund

Engineering Geology .... Tom Hite
.... Stu Twiss
.... D. H. Griswold
...........................J. L. Holland
......................*Charles E. Stearns

Erosion Control .... *Gary E. Formanek

Environment, Water Quality,
and Waste Disposal ....David Moffitt
.... *Don Stettler
Hydrology ....J. H. Dorroh, Jr.
.... Al Sharp
.... Robert E. Rallison
.... Wendell A. Styner

.... *Gary M. Conaway

Irrigation .... Donald A. Williams
.........................D. G. Shockley
.... Harlan G. Collins
.... Paul K. Koluvek
.... Elwin A. Ross
.......................*Larry J. Dawson

Landscape Architect ...... *Carolyn A. Adams

Planning .... Donald A. Williams
..............................E. J. Core
.... F. Rasmussen, Jr.
.... R. A. Mashburn, Jr.
............................Tom Curtis
.........................Larry J. Babich
.... Peter V. Patterson
.... *Joseph W. Sahlfeld

Recreation .... L. S. Augden
.... Clarence Maesner

River Basins .... C. R. Ness

Sedimentation Geology .... E. M. Flaxman
.... N. M. Curtis, Jr.
.... Peter V. Patterson
.... *Frank Reckendorf

Soil Engineering ....J. C. Stevenson
............................J. R. Talbot
...........................R. E. Nelson
.... Phil Jones
.... *Clifton E. Deal

Water Supply Forecasting ....Manes Barton
.........................*D. E. Johnson

Zone Engineers .... E. J. Core
..............................Ellis Hatt
.... Fred Larson
........................Allen McCulloch
.... Dell G. Shockley
.... M. V. Penwell
.... Orvil Hosmer
.... Charles W. Wilson

Fort Worth, Texas

Regional Engineer or Head . .Howard O. Matson
.... James J. Coyle
......................Howard O. Matson
..........................Jack W. Adair

.... Donald L. Basinger
.... *Robert A. Fronk, Jr.

Agricultural Engineering .... J. J. Coyle

	R. C. Barnes
	Walter K. Twitty
	*Douglas E. Seibel
Construction	F. E. Blackert
	J. H. Hopson
	E. N. Everett
	*Donald W. Shanklin
Design	C. M. Moore
	H. J. Behrens
	Donald L. Basinger
	Robert A. Fronk, Jr.
	*William H. Leeming
Drainage	T. C. Anderson
	Alonza Gibson
	K. V. Stewart, Jr.
	L. W. Herndon
	H. J. Foreman
	Richard D. Wenberg
	W. Kenneth Twitty, Jr
	*S. Rodney White, Jr
Engineering Geology	G. M. Brune
	R. H. Cole
	James B. Hyland
	*Homer H. Logan
Environment, Water Quality & Waste Disposal	G. A. Margheim
	J. P. Burt
	*David Moffet
Landscape Architecture	*Phillip B. Delucchi
Planning	Howard O. Matson
	Harold Kautz
	W. A. Weld
	J. H. Johnson
	Charles M. Moore
	Jack W. Adair
	R. Doug Peet
	William R. Thompson
	Luther H. McDougal
	Rue L. Boswell
Hydrology	James Jabriskie
	Jerry Andrews
	T. D. Snider
	Frank P. Erichsen
	Calvin Jackson
	*William Merkel
Irrigation	L. F. Lawhon
	Carl L. Anderson
	E. L. Alexander
	Carroll A. Hackbart
	Nelton O. Salch
Recreation	H. H. Wilkerson
	R. J. Miller
River Basins	L. D. Ledvina
	S. B. Owen
Sedimentation Geology	G. W. Renfro
	E. C. Nicholas, Jr.
	*Peter G. Waldo
Soil Engineering	R. B. Phillips
	Hal Norman
	*Charles H. McElroy
Groundwater	Dennis C. Erinakes
Zone Engineers	Phillip M. Price
	Charles M. Moore
	Jack W. Adair
	William T. Burtschi
	Nathan Falk
	Edwin. D. Butler
	Russel Grandbury
	Monroe Hartman

Milwaukee, Wisconsin

Regional Engineer or Head	R. W. Oberlin
	Edwin Freyburger
	C. E. Ghormley
Agricultural Engineering Construction	E. Freyburger
	William A. Weld
	Neil Bogner
Design	Melvin M. Culp
	H. J. Behrens
Drainage	Keith H. Beauchamp
	Guy B. Fasken
Engineering Geology	Earl F. Dosch
	A. F. Geiger
Hydrology	Frank P. Erichsen
Irrigation	K. H. Beauchamp
Planning	John S. Glass
	A. F. Moratz
	C. L. Overstreet
Sedimentation Geology	W. J. Abrams
Soil Engineering	David C. Ralston
Zone Engineers	Arthur W. Kowitz
	Paul Jacobson
	A. F. Kleinhenz

Unit discontinued 1964

STATE CONSERVATION ENGINEERS

Alabama
- Arvy Carnes
- R. M. Matthews
- A. B. Holland
- Henry A. Miller
- *Bobby Moore

Alaska
- James D. Louthan
- *Lewis L. Burton

Arizona
- J. J. Turner
- R. M. Arrington
- *R. J. Dekle

Arkansas
- Elwin D. Butler
- Lyle D. Bobeck
- Carl T. Peters
- *Dennis Carman

California
- Hal G. Enderlin
- Paul O. Tilker
- Hugh T. Shogren
- William R. Evans
- Lee P. Herndon
- Olice "Ted" Gerbaz
- *Charles Davis

Caribbean Area
- B. E. Davidson
- L. J. Ward
- A. N. Gibson
- P. Cantoni-Martin
- I. R. Emmanuelli
- John H. Geter
- Oscar Perez
- Benjamin Delgado
- *Warner Ivizarry

Colorado
- Charles H. Mitchell
- J. R. Fisher
- *Flavio Gonzales

Connecticut
- S. J. Smith, Jr.
- Ted R. Wire
- W. T. Ferguson, Jr.
- E. Minnick
- *William Ireland

Delaware
- E. L. Schmertzler
- J. W. Stingel
- Grady E. Griggs
- Emeron P. Christensen
- *Ronald F. Gronwald

Florida
- U. S. Allison
- D. E. Alcorn
- Douglas E. Hawkins
- Jesse Livingston
- James Martin
- Nelton Slach
- *Jesse T. Wilson

Georgia
- L. D. Worley
- Robert C. Robinson
- A. J. Dornbusch
- Robert C. Robinson
- *John P. McEvoy

Hawaii
- R. I. Blewitt
- H. T. Shogren
- Swayne Scott
- Harry N. Means
- William Annabelle
- Larry J. Babich
- *Gordon O. Klofstad

Idaho
- Meader H. Wilkins
- H. C. Moore
- *H. LeRoy Zollinger

Illinois
- O. T. Dobyns
- Joseph W. Haas
- Donald E. McCandless
- P. H. Christensen
- W. B. Moody
- M. C. Schendel
- *Harry Means

Indiana
- R. H. Austin
- John A. Geter
- Eugene J. Pope
- Max L. Evans
- *Jeffry W. Healy

Iowa
- Paul Jacobson
- Dewey T. Bondurant
- Douglas Seibel
- Don C. Peterson
- *Mark J. Jensen

Kansas
- George R. Smith
- *Jim R. Wallace

* Incumbent 1990

Kentucky
- J. M. Burns
- Joseph R. Davis
- *Billy P. Hartsell

Louisiana
- K. V. Stewart, Jr.
- Larkin B. Agnew
- *Harry Hawthorne

Maine
- Glenn W. Grubb
- R. H. Stone
- Frank R. Farmer
- *Arthur G. Dearborn

Maryland
- J. Turnbull
- K. P. Jarvis
- William P. Weldon
- Richard R. Nagle
- *John W. Mickley

Massachusetts
- M. H. Hubler
- Z. E. Mills
- Karl A. Klingelhofer
- Donald L. Basinger
- Cecil B. Currin
- *Carl Gustafson

Michigan
- E. A. Zack
- J. W. Waterman
- Glen E. Stucky
- W. J. Ochs
- Loren L. Oshel
- Howard Belcher, Jr.
- Edwin L. Minnick
- *Stephen Davis

Minnesota
- J. H. Maher
- R. A. St. John
- Richard D. Wenberg
- R. C. Bintzler
- Richard M. Rovang
- *John C. Brach

Mississippi
- H. H. Lester
- J. B. Furr
- Peter Forsythe
- *Richard L. Peace

Missouri
- W. S. Culpepper
- James M. Dale
- *Hugh A. Curry

Montana
- Eugene H. Sperry
- Bobby B. Gemmell
- Homer Moore
- Raymond Smith
- R. W. Van Klaveren
- *James D. Suit

Nebraska
- D. R. Vallicott
- Leland G. Jackson
- *Thomas Hamer

Nevada
- V. J. Allen
- *Loren J. Spencer

New Hampshire
- Charles E. Fogg
- L. F. Silverberger
- Jesse L. Hicks
- Charles H. Dingle
- Henry S. Stamatel
- W. A. Jolly
- Tillman Marshall
- *Gerald J. Lang

New Jersey
- K. S. Werkman
- Richard H. Marston
- Donald W. Haslem
- Carmelo J. Montana
- *John A. Tibbetts

New Mexico
- C. W. Bennett
- C. J. McCash
- Roy D. Thompson, Jr.
- E. C. Vittetoe
- Roy D. Thompson, Jr.
- *J. Gordon O'Dell

New York
- W. S. Atkinson
- Richard L. Phillips
- Donald W. Shanklin
- Lloyd Thomas
- Phillip Nelson
- *Donald M. Lake, Jr.

North Carolina
- G. L. Sherman
- Robert G. Jessup
- *Harry J. Gibson

North Dakota
- Walter A. Augustadt
- Wayne D. Wavrin
- Clinton R. Johnson
- A. R. Moum
- Thomas Fleming
- Ronald D. Sando
- *Wesley J. Wiedenmeyer

Ohio
- A. F. Kleinhenz
- Joseph H. Harrington
- *Arthur M. Brate

Oklahoma
- William T. Burtschi
- K. S. Cornforth
- Robert Gray
- *Larry W. Caldwell

Oregon
.... M. V. Penwell
.... Roy L. Fox
.... *Roy E. Bright

Pennsylvania
.... F. R. Brower, Jr
.... Paul E. Nylander
.... C. M. Right
.... Buell M. Ferguson
.... Edgar L. Hemley
.... Mervin Ice
.... *William Bowers

Rhode Island
.... (Serviced by Conneticut)

South Carolina
.... J. L. Aull
.... S. T. Currin
.... W. Burton Wells
.... *H. Grady Adkins

South Dakota
.... Clarence D. Brehm
.... David J. Tokash
.... Keith O. Nelson
.... *Dwight D. Hale

Tennessee
.... R. L. Lester
.... L. F. Siverberger
.... Carl Toney
.... O'Gene Barkemeyer
.... Paul Lucas
.... Phillip H. Smith

Texas
.... Phillip M. Price
.... Gene C. Vittetoe
.... Cecil Currin
.... *O'Gene Barkemeyer

Utah
.... George A. Lawrence
.... Gilbert P. Searle
.... Phillip D. Coombs
.... *G. Arthur Shoemaker

Vermont
.... K. P. Wilson
.... Richard A. Gallo
.... *Richard J. Croft, Jr.

Virginia
.... W. A. Allaband
.... R. C. Barnes, Jr.
.... Louis S. Button, Jr.
.... *Berry Kintzer

Washington
.... Earl W. Cowley
.... Stanley Hobson
.... Donald W. Haslem
.... W. J. Carmack
.... *Julian L. Meuer

West Virginia
.... H. M. Rhodes
.... D. C. Ralston
.... James L. Dove
.... *Michael M. Blaine

Wisconsin
.... A. W. Kowitz
.... Marvin L. Knabach
.... *Leo J. Wiley

Wyoming
.... Dale Harper
.... C. L. Endicott
.... John R. Long
.... *Duane Klamm

AWARDS TO SCS ENGINEERS AND RELATED PROFESSIONALS

USDA DISTINGUISHED SERVICE AWARDS

1958 .... Donald A. Williams .... Washington, DC
1980 .... Robert E. Rallison .... Washington, DC

WILLIAM A. JUMP MEMORIAL FOUNDATION AWARD

1951 .... Talcott W. Edminister

ROCKEFELLER PUBLIC SERVICE AWARD

1967 .... Donald A. Williams

SCS ENGINEER OF THE YEAR AWARD

1981 .... Neil F. Bogner .... Washington, DC
1982 .... Walter J. Ochs .... Washington, DC
1983 .... Charles H. McElroy .... Fort Worth, TX
1984 .... Robert L. Gray .... Stillwater, OK
1985 .... Gene C. Vittetoe .... Temple, TX
1986 .... James R. Talbot .... Washington, DC
1987 .... David C. Moffitt .... Portland, OR
1988 .... Richard W. Van Klaveren .... Bozeman, MT
1989 .... James N. Krider .... Washington, DC
1990 .... Kathryn Bird-Humphreys .... Artesia, NM
1991 .... John C. Tiedeman .... Sacramento, CA
1992 .... Hugh A. Curry .... Columbia, MO
1993 .... Victor W. E. Payne .... Alburn, AL

PRESIDENTIAL DESIGN AWARD

1985 .... Pine Creek Detention Basin, Contra Costa County, CA
Charles Davis, Design Engineer
Robert E. Snieckus, Landscape Architect
Olice "Ted" Gerbaz, State Conservation Engineer

HARVARD GRADUATE SCHOOL OF DESIGN

Loeb Fellowship Award
1976-77 .... Sally Schauman
1983-84 .... Carolyn Adams

USDA SUPERIOR SERVICE AWARDS

1948 .... William X. Hull .... Washington, DC
1948 .... Lewis A. Jones .... Washington, DC
1948 .... Ralph L. Parshall .... Fort Collins, CO
1949 .... Allan W. McCulloch .... Portland, OR
1949 .... Walter Wesley McLauchlin .... Berkeley, CA
1950 .... Fred W. Blaisdell .... Minneapolis, MN

1950	Irwin L. Saveson	Baton Rouge, LA
1951	Harry F. Blaney	Los Angeles, CA
1951	Talcott W. Edminister	Blacksburg, VA
1952	Karl Harris	Phoenix, AZ
1952	William L. Heard	Albany, MI
1954	Glen H. Baker	Elkins, WV
1956	Robert A. Work	Portland, OR
1959	Carl B. Brown	Washington, DC
1959	Edwin Freyburger	Milwaukee, WI
1959	Ellis Hatt	Portland, OR
1962	Eugene C. Buie	Spartanburg, SC
1964	Louis C. Gottschalk	Washington, DC
1964	Harold O. Ogrosky	Washington, DC
1965	Gail W. Eley	Upper Darby, PA
1965	Chester J. Francis	Washington, DC
1966	Francis K. Muceus	Portland, OR
1973	William L. Heard	Jackson, MI
1973	Elliott M. Flaxman	Portland, OR
1977	Joseph W. Haas	Washington, DC
1978	Galen S. Bridge	Spokane, WA
1980	Charles H. McElroy	Fort Worth, TX
1981	Homer H. Logan	Fort Worth, TX
1982	John P. Burt	Fort Worth, TX
1982	Donald R. Vandersypen	Stillwater, OK
1990	William J. Irwin	Chester, PA
1992	William H. Boyd	Lincoln, NE

PROFESSIONAL SOCIETY AWARDS

American Society of Agricultural Engineers
Past Presidents

1946	Mark L. Nichols
1952	Ivan D. Wood
1968	Talcott W. Edminister

Cyrus Hall McCormick Medal

1934	Mark L. Nichols

The John Deere Medal

1940	Walter W. McLaughlin
1944	Charles E. Ramser
1949	H. H. Bennett
1952	Ivan D. Wood
1966	Harry F. Blaney
1968	Dwight D. Smith
1970	Wayne D. Criddle
1977	Jan van Schilfgaarde
1978	Lloyd L. Harrold
1981	Claude H. Pair
1985	Neil F. Bogner

Hancock Soil and Water Engineering Award

1966	William W. Donnan
1970	John R. Carreker
1973	E. Paul Jacobson

1975 .... Elmer W. Gain
1977 .... Benjamin A. Jones, Jr.
1991 .... William O. Ree

American Society of Civil Engineers
Norman Medal
1938 .... Hunter Rouse
1985 .... James R. Talbot
1985 .... Lorn P. Dunnigan

Arthur M. Wellington Prize
1973 .... Rey S. Decker
1973 .... Norman L. Ryker

Rickey Medal
1949 .... Fred W. Blaisdell

The Theodore von Karman Medal
1963 .... Hunter Rouse

The Karl Emil Hilgard Hydraulic Prize
1949 .... Vito A. Vanoni
1951 .... Hunter Rouse
1961 .... Hunter Rouse

The J.C. Stevens Award
1960 .... Hans A. Einstein
1969 .... Fred W. Blaisdell
1978 .... Vito A. Vanoni

Hunter Rouse Hydraulic Engineering Lectureship
1983 .... Vito A. Vanoni

Royce J. Tipton Award
1966 .... Harry F. Blaner Sr.
1971 .... William F. Donnan
1972 .... George D. Clyde
1978 .... Elmer W. Gain
1980 .... Clyde E. Houston

Hans Albert Einstein Award
1989 .... Vito A. Vanoni

Civil Engineering History and Heritage Award
1980 .... Hunter Rouse

Civil Government Award
1965 .... George D. Clyde

American Society of Landscape Architects
Honor Award
1989 .... Gary Wells
1989 .... Ronald W. Tuttle

Chronology

31 07 01.......................The Division of Agricultural Engineering of the Bureau of Public Roads became the Bureau of Agricultural Engineering.

33 03 31.......................Civilian Conservation Corps Camps authorized by the Emergency Conservation Work Act (48 Statutes at Large 22-23).

33 04 05.......................President Roosevelt signed the executive order establishing the CCC Camps.

33 05 12.......................Agricultural Adjustment Act signed by the President.

33 08 25.......................Soil Erosion Service established in the U.S. Department of the Interior.

33 09 19.......................Operation of the Soil Erosion Service begun. H. H. Bennett transferred from USDA as Director of SES.

33 10 10.......................The first soil erosion control project, the Coon Creek Project, was established in Coon Valley, WI.

33 10 16.......................Walter C. Lowdermilk entered on duty as Vice-Director of SES.

33 11 27.......................The first emergency labor was allocated to the Service by the Civil Works Administration.

34 01 24.......................William A. F. Stephenson entered on duty as Chief of Operations.

34 02 15.......................Civil Works program of emergency labor discontinued. 1,835 men had been assigned to work on seven of the regularly established projects.

34 04 01.......................Twenty-two ECW Camps put under the direction of SES.

34 05 11.......................Great dust storm in the "Dust Bowl" occurred sweeping fine soil particles over Washington, DC and 300 miles out into the Atlantic Ocean.

34 06............................National Resources Board succeeds National Planning Board. Later reestablished as National Resources Committee.

34 06 30.......................SES has 2200 employees. Average CCC camp enrollment, 193 men of whom 82 percent were between 18 and 25 years of age, 13 percent were veterans, and 13 percent were experienced men. SCS supervision and facilitation averaged 9.85 employees per camp.

34 10 23.......................First issue of "THE LAND" Today and Tomorrow" distributed.

35 03 27.......................SES transferred to the USDA by Departmental Memorandum 665. Thirty-nine erosion control projects and 51 ECW camps active.

35 04 27.......................Soil Conservation Act of 1935 (P.L. 46, 74th Cong.) approved. Soil Conservation Service established in USDA, with H. H. Bennett, Chief.

35 06 06.......................Secretary approved a recommendation that after 1 July 1937 that erosion-control work on private land be accomplished through legally constituted Soil Conservation Associations.

35 06 25.......................First CCC Drainage Camp, located at Bancroft, IA, established.35 06 30SCS has 6,622 employees of which 320 were located in Washington.

35 07 24.......................Water Resources Committee appointed. Outgrowth of National Resources Committee of June 1934.

35 07 30........................SCS's first Region, Southwest Region (Region 8) established at Albuquerque, NM.

35 08 01........................"Soil Conservation" magazine authorized.

35 09 19........................Southeast Region (Region 2) established at Spartanburg, SC.

35 09 19........................Northeast Region (Region 1) established; permanent headquarters at Williamsport, PA.

35 09 30........................Midsouth Region (Region 4 established at Fort Worth, TX.

35 10 08........................Water Resources Committee submitted a report relating to Small Water Storage Projects.

35 10 21........................Southern Great Plains Wind Erosion Region (Region 6) established at Amarillo, TX.

35 10 21........................Pacific Northwest Region (Region 11) established at Spokane, WA.

35 10 21........................Pacific Southwest Region (Region 10) established at Santa Paula, CA.

35 10 26........................Ohio Valley Region (Region 3) established; permanent headquarters at Dayton, OH.

35 11 05........................Division of Cooperative Relations redesignated the Division of Cooperative Relations and Planning.

35 11 29........................Northwest Region (Region 9) established; permanent headquarters at Rapid City, SD.

35 12............................Thomas B. (Jack) Chambers appointed Chief, Engineering Division, SCS.

35 12 02........................Central Great Plains Region (Region 7) established; permanent Headquarters at Salina, KS.

35 12 11........................Upper Mississippi Region (Region 5) established at Des Moines, IA.

35 12 27........................Competitive classified Civil Service status acquired by 10,325 employees.

35 12 31........................SCS operating 498 ECW (CCC) camps, the maximum number achieved.

36 01 06........................Supreme Court invalidated production control provisions of Agricultural Adjustment Act of 1933.

36 02 10........................Program Divisions included Research, Cooperative Operations, and Cooperative Relations and Planning.

36 02 29........................Soil Conservation and Domestic Allotment Act of 1936 passed permitting soil-conserving payments.

36 06 22........................Flood Control Act of 1936 (P.L. 74-738) approved.

36 06 30........................SCS had 11 regional offices, 147 demonstration projects, 48 nurseries, 23 Experiment Stations and 454 CCC camps employing 10,394 persons.

36 09 26........................23,709 WPA relief laborers employed by SCS, the peak number attained.

36 11 30........................Demonstration areas in Puerto Rico initiated.

37 02 23........................President Roosevelt submitted to the Governors of all States a recommended standard Soil Conservation District law.

37 02 27........................President Roosevelt wrote State Governors urging passage of State legislation to effectuate a soil conservation district program.

37 03 03........................First Soil Conservation District law in U.S. enacted in Arkansas.

37 06 28........................The Civilian Conservation Corps Act approved (50 Statutes at large 319-22).

37 06 30........................Employees in SCS (ECW and SCS) numbered 13,245 people.

37 07 07........................The Division of Watershed and Conservation Surveys established.

37 07 22........................Land Utilization programs authorized by the Bankhead-Jones Farm Tenant Act, (P.L. 75-210) initiated and administered by the Resettlement Administration, USDA.

37 08 04........................First Soil Conservation District in U.S., the Brown Creek Soil Conservation District, organized in North Carolina.

37 08 28........................The Water Facilities Act Of 1937 (P.L. 75-399) approved.

38 02 16........................The Agricultural Adjustment Act of 1938 approved establishing a policy of parity prices.

38 06 16........................Regional Office, Region 1, transferred to Upper Darby, PA.

38 06 28........................The Flood Control Act of 1938 (P.L. 761 - 75th Congress) approved.

38 06 30........................SCS had 25,481 employees including 4,986 operating CCC camps.

38 07 01........................Action phases of the Water Facilities Act of 1937 assigned to the Soil Conservation Service.

38 08 28........................Flood Control Act of 1937 (P.L. 406 - 75th Congress) approved.

38 10 16........................The Bureau of Agricultural Engineering was abolished and its functions transferred to the Bureau of Agricultural Chemistry and Engineering and the Bureau of Plant Industry.

38 11 01........................Administration of Land Utilization and Retirement of Submarginal Land programs transferred from Resettlement Administration to the Soil Conservation Service.

38 12 03........................Drainage and irrigation responsibilities previously held by the Bureau of Agricultural Engineering were transferred to the Soil Conservation Service.

38 12 19........................Area Office organization policy established.

39 01 01........................First Soil Conservation work in Hawaii.

39 01 02........................Research programs in irrigation, drainage, and snow survey transferred to SCS from the Bureau of Agricultural Engineering.

39 01 21........................Regional Office (Region 9) moved from Rapid City, SD, to Lincoln, NE.

39 03 01........................Regional Office at Salina, KS closed transferring functions to other regions.

39 03 27........................Regional Office (Region 5) transferred from Des Moines, IA to Milwaukee, WI.

39 05 15........................Regional Office (Region 10) transferred from Santa Paula, CA to Berkeley, CA.

39 06 01........................Region 11, embracing WA, OR and ID was designated as Region 9.

39 06 01........................Region 9, embracing NE, SD, ND, WY and MT was designated as Region 7.

39 06 20........................SCS Regional Offices now located at Upper Darby, PA, Spartanburg, SC, Dayton, OH, Fort Worth, TX, Milwaukee, WI, Amarillo, TX, Lincoln, NE, Albuquerque, NM, Spokane, WA and Berkeley, CA.

39 06 20........................SCS reorganized to reflect new responsibilities. The organization included the following Divisions: Land Management, Institutional Adjustments, Land Acquisition, Farm Planning and Management, Engineering, Agronomy, Forestry, Range Conservation, Nursery, Biology, Climatic and Physiographic, Sedimentation Studies, Irrigation, Hydrologic, Conservation Economics, Hillculture, Drainage, Conservation Experiment Stations, Physical Surveys, Economic Surveys, Cartography, Project Plans, States Relations, and Program Procedures.

39 06 30........................SCS employees numbered 20,218 plus 17,896 WPA laborers.

39 07 01........................Thirty-eight CCC Drainage Camps were transferred to the SCS from the Bureau of Agricultural Engineering.

39 07 01........................Division of Irrigation and Drainage, Bureau of Agricultural Engineering transferred to SCS.

39 07 01........................Region 9, Spokane, WA given responsibility for work in AK.

39 07 01........................Region 10, Berkeley, CA given responsibility for work in HI.

39 07 01........................Region 2, Spartanburg, SC given responsibility for work in PR.

39 07 01........................Land Utilization Program (LU) transferred to the SCS from the Bureau of Agricultural Economics.

39 08 11........................The Flood Control Act of 1939 (P.L. 396 - 76th Congress) approved.

39 08 11........................Case-Wheeler Projects authorized (P.L. 76-398).

39 11 27........................Flood Control operations assigned to the Soil Conservation Service.

40 06 30........................Employees in the SCS numbered 4,369 in the CCC programs, 11,065 full-time and 1,282 part-time in the SCS programs, totaling 16,716.

40 06 30........................Responsibility for soil and water conservation on public lands under the US Department of the Interior was transferred from the SCS to the USDI.

40 07 01........................Weather Bureau transferred from USDA to the Department of Commerce. SCS retained authority for making snow surveys.

40 10 14........................Wheeler-Case Act amended.

40 11 01........................One hundred seventy-six demonstration projects active.

40 11 01........................One hundred seventy-four demonstration projects were active in 45 states.

41 05 22........................First Civilian Public Service Camp was assigned to SCS.

41 06 30........................SCS had 9,038 full- and part-time employees plus 4,445 assigned to the CCC.

41 08 18........................The Flood Control Act of 1941 (P.L. 228 - 77th Congress) approved.

42 05 05........................Farm Drainage, Hydrologic, Sediment Studies, and Climatic and Physiologic Divisions were assumed by the new Erosion Control Practices and Water Conservation and Disposal Practices Divisions.

42 07 01 ....Water Facilities Program transferred to the Farm Security Administration from the Soil Conservation Service (Secretary's Memo 969).

42 07 01 ....Reorganization eliminated 3 regional headquarters leaving Region 1 at Upper Darby, PA, Region 2 at Spartanburg, DC, Region 3 at Milwaukee, WI, Region 4 at Fort Worth, TX, Region 5 at Lincoln, NE, Region 6 at Albuquerque, NM, and Region 7 at Portland, OR.

42 07 06 ....The SCS Washington Office included the Land Acquisition, States Relations, Agronomy, Range, Engineering, Biology, Nursery, Forestry, Land Management, Project Plans, Soil Conservation Surveys, Cartographic, Erosion Control Practices, Water Conservation and Disposal Practices, and Irrigation Divisions.

43 02 13 ....The Bureau of Agricultural Chemistry and Engineering was abolished and some functions transferred to the Bureau of Plant Industry, Soils and Agricultural Engineering.

43 04 19 ....SCS became a part of the War Food Administration within the USDA.

43 06 30 ....SCS had 7,301 full time and 3,692 part time employees. More than 2,500 (later exceeding 3,000) were on military furlough.

43 07 01 ....Flood control work suspended for the duration of World War II.

43 07 16 ....Wheeler-Case Act amended.

44 06 30 ....Final closing date for work in demonstration projects.

44 06 30 ....The Water Conservation Division was established.

44 06 30 ....SCS employees, full- and part-time, numbered 9,449.

44 12 22 ...."Pick-Sloan Plan" for development in the Missouri River Basin authorized by the Flood Control Act of 1944 (P.L. 78-534) .

45 03 30 ....Wheeler-Case projects were transferred from the Farm Security Administration to the Soil Conservation Service.

45 03 30 ....The War Food Administration was terminated. SCS continued as a separate agency within the USDA.

45 06 30 ....SCS employees, full- and part-time, numbered 12,328.

45 07 01 ....Suspended flood control work was resumed and surveys and investigations proceeded on additional watersheds.

46 06 30 ....SCS had 15,724 full- and part-time employees.

46 07 24 ....The Flood Control Act of 1946 (P.L. 526 - 79th Congress) approved.

46 10 01 ....SCS had the following Divisions: Land Acquisition and Sales, States Relations, Agronomy, Biology, Cartographic, Engineering, Forestry, Nursery, Land Management, Project Plans, Range, Soil Conservation Surveys, Water Conservation, Erosion Control Practices, Farm Irrigation, and Water Conservation and Disposal Practices.

47 06 30 ....SCS had 12,781 full- and part-time employees.

47 07 26 ....Authority to work in the Virgin Islands clarified.

47 08 28 ....Last of the 15 Civilian Public Service Camps assigned to the SCS was discontinued.

47 12 16........................SCS reorganized discontinuing Camp Operations Division and the Land Acquisition and Soils Division.

48 02 16........................SCS office opened in Alaska.

48 06 30........................SCS had 12,087 full- and part-time employees.

48 09 21........................The SCS Assistant Chief appointed a committee to "prepare a handbook setting forth service-wide guides covering design criteria, design procedures, standard specifications and contract procedures."

49 06 29........................Authority given for the Agricultural Conservation Program to provide funds, not to exceed 5 percent of their allocation, to the SCS for services of SCS technicians in carrying out agricultural conservation programs.

49 06 30........................SCS had 14,431 full- and part-time employees.

49 07 01........................Engineering Standards Unit established at Lincoln, NE.

49 09 29........................"Young Plan" of USDA to provide soil and water conservation in the Missouri River Basin and supplement the "Pick-Sloan Plan" submitted to Congress.

50 06 30........................SCS had 14,682 full- and part-time employees.

50 07 18........................States Relations Division, SCS abolished.

51 02 15........................SCS made responsible for all technical phases of the permanent types of soil conservation work undertaken by the Production and Marketing Administration.

51 03 30........................President Truman authorized the extension of the services of H. H. Bennett to April 30, 1952.

51 06 30........................SCS had 14,665 full- and part-time employees.

51 11 13........................Robert M. Salter appointed Chief of the Soil Conservation Service succeeding H. H. Bennett.

52.................................Engineering Standards Unit moved to Beltsville, MD and became the Design Section.

52 01 11........................The Design and Construction Division was established; the Engineering Division was abolished. The functions of the Division s of Agronomy, Biology, Forestry, Nursery, Range, and Land Management were combined in the Engineering Practices Division.

52 01 22........................The Water Conservation Planning Division was established; the Engineering Division was abolished; and the Design and Construction Division was established.

52 01 22........................SCS Water Conservation Planning Division was established to take over most of the functions of the Water Conservation Division.

52 01 23........................SCS Division of Irrigation and Water Conservation was redesignated the Division of Irrigation Engineering and Water Conservation.

52 06 30........................SCS had 13,965 full and part time employees.

52 07 01 .... Flood Rehabilitation Act of 1952 made funds available to SCS for emergency channel restoration, land restoration, and flood rehabilitation in designated flood disaster areas.

52 11 15 .... SCS given responsibility for all soil survey activities.

53 01 16 .... The Water Conservation and Disposal Practices, Erosion Control Practices, Water Conservation and Irrigation Engineering Divisions were deleted.

53 04 01 .... General responsibility for administration of all of the Department's flood control and river basin investigation activities was assigned to SCS.

53 06 30 .... SCS had 14,726 employees.

53 07 20 .... 183 preliminary examinations of small watershed had been completed and 25 detailed survey reports had been submitted to Congress.

53 07 28 .... Funds appropriated for demonstrations of combined soil conservation and flood control in 50 or more small pilot watersheds.

53 11 02 .... All research except for the national soil survey was transferred from the SCS to the Agricultural Research Service.

53 11 02 .... Management of the Land Utilization Projects was transferred from the Soil Conservation Service to the Forest Service.

53 11 02 .... The seven Regional Offices of the SCS were abolished. State and Territorial offices were established.

53 11 02 .... Donald A. Williams appointed Acting Administrator of SCS.

53 11 27 .... Donald A. Williams appointed Administrator of SCS, succeeding Robert M. Salter.

53 12 11 .... SCS Design and Construction Branch designated.

53 12 11 .... SCS Water Conservation Planning Branch designated.

54 01 01 .... Effective date of the transfer of research activities to ARS.

54 01 01 .... Land Utilization and Retirement of Submarginal Land Program transferred to Forest Service.

54 06 08 .... SCS Central Technical Unit established at Beltsville, MD with Woody L. Cowan, Head; Victor Mocus and H. N. Holtan, Hydrologists, and Victor H. Jones, Geologist. The CTU became responsible for some of the functions previously carried out by the Design Section.

54 06 30 .... Emergency flood rehabilitation work in designated areas substantially finished.

54 06 30 .... Number of employees in the SCS was 13,546.

54 07 02 .... Policy on technical assistance to foreign countries established in Relations Memorandum-4.

54 07 20 .... The procedure for review and approval of engineering plans established by Engineering Memorandum-6.

54 07 20 .... Policy for the preparation of technical standards given in Engineering Memorandum-6.

54 08 04........................The Watershed Protection and Flood Prevention Act (P.L. 83-566) was approved terminating USDA activities under the Flood Control Act of 1936 except in the 11 Authorized Watersheds. SCS was designated as the USDA action agency.

54 08 17........................By amendment, the Farmers Home Administration was given responsibility for administration of the Water Facilities Act (P.L. 83-597). The SCS to cooperate as requested by the FmHA.

54 09 10........................Preparation of Farm Planners Engineering Handbook directed by Engineering Memorandum-8.

54 09 29........................The outline for the preparation of the National Engineering Handbook established by Engineering Memorandum-9.

55 05 12........................SCS reorganized. Engineering Division reports to the Assistant Administrator for Field Services.

55 06 30........................SCS had 14,973 employees assisting 2,654 conservation districts and 20 other districts in all states and territories.

56 08 07........................Watershed Protection and Flood Prevention Act was broadened to include agricultural water management purposes.

56 08 07........................Great Plains Program authorized (Public Law 84-1021).

57 04 26........................Operations of the Soil Mechanics Laboratory defined in Engineering Memorandum-21.

57 05 03........................Engineering classification of soils established by Engineering Memorandum-22.

57 12 09........................Authorities for the review and approval of high hazard dams established in Engineering Memorandum-23.

58 05 09........................Policy on group enterprise jobs established in Engineering Memorandum-29.

58 08 12........................Fish and wildlife aspects included in watershed projects.

58 09 02........................Cost-sharing authorized for fish and wildlife projects.

58 11 01........................SCS River Basin and Watershed Planning Divisions established.

60 06 20........................USDA created National Grasslands from 22 Land Utilization projects in eleven western states.

60 06 27........................Act relating to the preservation of historical and archeological data enacted.

61 03 09........................First policy on registration as a Professional Engineer established in Engineering Memorandum-44.

62 09 27........................Cost sharing for recreation purposes in watershed projects authorized.

62 09 27........................Food and Agriculture Act of 1962 enacted (P.L. 87-703).

62 10 02........................Drainage Referral Act (P.L. 87-732) enacted.

63.................................The Design Section and Central Technical Unit were moved to the Federal Center Building in Hyattsville, MD.

63 07 30........................Instructions for the investigation of structure deficiencies issued in Engineering Memorandum-53.

64.................................The Design Section became the Design Unit.

64 ....Resource Conservation and Development projects begun under the authority of Food and Agriculture Act of 1962.

64 05 22 ....Four Regional Technical Service Centers established through Administrators General Memorandum-1.

64 08 07 ....Administrator defines the interrelationships of the Washington Office, the Engineering and Watershed Planning Units and the State Offices by Administrators General Memorandum-2.

65 05 24 ....White House Conference on Natural Beauty transmitted 10 specific recommendations to the President on Agriculture and the Landscape.

65 06 30 ....SCS technical services consolidated into four Regional Technical Service Centers; Upper Darby, PA, Fort Worth, TX, Lincoln, NE, and Portland, OR.

65 07 22 ....Water Resources Council established.

65 08 12 ....SCS policy on Natural Beauty of the Countryside established in Environmental Memorandum-2.

65 09 23 ....Agreement between the SCS and Corps of Engineers with respect to Flood Protection by engineering works was signed.

65 11 03 ....Limitations for the provision of technical assistance for drainage works defined in Inter-Agency Memorandum-8.

65 11 08 ....SCS authority for storage reservoirs increased from 5,000 to 12,500 acre feet.

66 09 01 ....Policy on the Prevention, Control and Abatement of Water Pollution defined in Inter-Agency Memorandum-11.

67 ....Design Unit and Central Technical Unit moved to Lanham, MD.

67 09 18 ....Staffing and responsibility of the E&WP Units established by Engineering Memorandum 26 (Rev. 1).

68 03 19 ....Secretary's Memo 1631 made the quality of the environment a basic policy of the Department.

68 06 27 ....Authority given to contract for the construction of works of improvement at the request of the local organization.

69 01 12 ....Kenneth E. Grant appointed Administrator, SCS, succeeding D. A. Williams.

69 02 27 ....Job Approval Authorities for State Conservation Engineers established.

70 01 01 ....National Environmental Policy Act of 1969 (P.L. 91-190) enacted.

70 07 29 ....Field studies on the performance of emergency spillways directed by Engineering Memorandum-74.

72 ....Last of the Pilot Watershed Projects were completed.

72 01 14 ....Policy on the Preservation of Historical and Archeological Data and Historic Sites established in Environmental Memorandum-8.

72 08 30 ....Authority for water quality management, pollution control, municipal and industrial water supply given in connection with watershed protection projects.

73 01 22........................Administrative direction of Soil Mechanics Laboratory assigned to Midwest RTSC.

73 01 22........................Administrative responsibility for the Soil Mechanics Laboratory at Lincoln, NE transferred from the Engineering Division to the Midwest Regional Technical Service Center by Personnel Memorandum-117 (Rev. 2).

73 01 22........................Organization of Engineering Division defined by Personnel Memorandum-117 (Rev. 2).

73 02 13........................SCS policy to deny technical assistance in the drainage of Types 3, 4 and 5 wetlands adopted.

75 03 31........................Policy on Landscape Architecture in the SCS defined in Engineering Memorandum-75.

75 06 01........................R. Melvin Davis appointed Administrator, SCS, succeeding Kenneth E. Grant.

76 07 01........................SCS has been involved in the construction of 2,566,615 dams of all sizes -- large multipurpose structures to farm ponds.

77 04 01........................1,185 watershed projects had been approved for operations and 434 of these had been completed.

77 04 23........................The President directed all agencies to emphasize dam safety.

77 05 23........................Executive Order 11988, Floodplain Management issued.

77 05 24........................Executive Order 11990, Protection of Wet Lands issued.

77 08 08........................Rule requiring Environmental Impact Statements on SCS projects published in the Federal Register.

77 09 02........................Secretary of Agriculture directed plans for dam safety be developed.

77 10 01........................Administrative approval of watershed work plans from $150,000 to $1,000,000 given.

78 06 ....SCS plan for dam safety developed.

79..................................National Engineering Staff established to include the Design Unit, the Central Technical Unit and Others. The Central Technical Unit was renamed the Hydraulic Unit.

79 05 29........................National Engineering Manual established.

79 09 12........................Norman Berg appointed Chief, SCS, succeeding R. Melvin Davis.

81 12 22........................Agricultural and Food Act of 1981 (P.L. 97-98) approved.

82..................................National Engineering Staff became a part of the National Engineering Division located at Lanham, MD.

82 04 04........................Peter Myers appointed Chief, SCS, succeeding Norman Berg.

83..................................Lanham Staff moved to Cotton Annex, Washington, DC.

85 03 20........................Peter Myers appointed Assistant Secretary, Natural Resources and Environment, USDA.

85 05.............................Study of USDA's agencies to evaluate the potential for contracting activities to the private sector and potential for sharing some responsibilities between agencies conducted.

85 05 21 ....Wilson Scaling appointed Administrator, SCS, succeeding Peter Myers.

85 12 23 ....Food Security Act of 1985 (P.L. 99-198) enacted.

86 ....A Productivity Improvement Program for engineering was conducted.

86 ....Engineering Software Work Group (ESWG) established.

86 04 15 ....Productivity Improvement Program in SCS initiated.

87 ....Field Office Engineering Software (FOES) project implemented.

88 ....A National Water Quality Staff for Technology Development was established and located in Fort Worth, TX.

88 ....USDA/SCS established policy to provide technical assistance for quality and quantity of both surface water and groundwater.

88 08 23 ....Productivity Improvement study distributed.

88 10 28 ....Memo of Agreement signed with Land Improvement Contractors of America to assist training contractors to apply engineering practices.

89 ....Water Quality Technology Development Staff established at the South National Technical Center.

89 ....National Engineering Staff was reorganized as the Engineering Technology Software Development and Maintenance Staff under an Assistant Director, Engineering Division.

89 06 28 ....Schedule established to implement the recommendations of the Engineering Management Improvement Plan.

89 10 ....Stillwater Outdoor Hydraulic Laboratory designated a historic landmark by the American Society of Civil Engineers Dedication on 90 02 23.

90 07 13 ....Roy M. Gray appointed Acting Chief, SCS, following the retirement of Wilson Scaling.

90 12 16 ....William J. Richards became Chief of SCS.

Index of Acronyms

AAA...................... Agricultural Adjustment Administration
ACP .... Agricultural Conservation Program
ARS .... Agricultural Research Service
ASDSO................ Association of State Dam Safety Officials
ASTM.................. American Society for Testing Materials
BAE .... Bureau of Agricultural Engineering
CCC .... Civilian Conservation Corps
CTU .... Central Technical Unit
CWA..................... Civil Works Administration
DS .... Design Section
DU .... Design Unit
EAP .... Emergency Action Plan
ECW..................... Emergency Conservation Work
EPA .... Environmental Protection Agency
ESU .... Engineering Standards Unit
E&WP Unit........ Engineering and Watershed Planning Unit
FAO...................... Food and Agricultural Organization (UN)
FOES................... Field Office Engineering Software
FSA....................... Farm Security Administration
IPOT..................... Inventory of Proven Operational Technology
NEH...................... National Engineering Handbook
NTC .... National Technical Center
RC&D .... Resource Conservation and Development
SCS........................ Soil Conservation Service
SES........................ Soil Erosion Service
SML .... National Soil Mechanics Laboratory
TSC .... Technical Service Center
USBR .... U.S. Bureau of Reclamation
USDA................... U.S. Department of Agriculture
USDI.................... U.S. Department of the Interior
VCC...................... Veterans Conservation Corps
WPA .... Works Progress Administration